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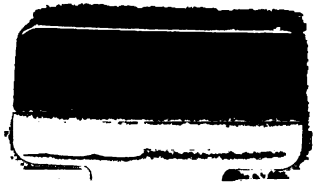

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PROCEEDINGS

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OF THE

AMERICAN GAS-LIGHT ASSOCIATION,

AT

MEETINGS

HELD ON

APRIL 16 AND 17, 1873, IN THE CITY OF NEW YORK; OCTOBER 15 AND 16, 1873, IN THE CITY OF NEW YORK; MAY 13 AND 14, 1874, IN THE CITY OF CLEVELAND, OHIO; AND ON OCTOBER 21 AND 22, 1874, IN THE CITY OF BROOKLYN, N. Y.

A. M. CALLENDER & CO.,
PUBLISHERS,
42 PINE STREET, NEW YORK.
1875.

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PROCEEDINGS

OF THE

AMERICAN GAS-LIGHT ASSOCIATION.

The first meeting of this Association was held in pursuance of the following call, issued at an informal preliminary meeting, held in the city of Cleveland, Ohio, in September, 1872.

CALL:

DETROIT, March 12, 1873.

You are requested to appoint, not to exceed three delegates, to attend a convention of gentlemen from the Illuminating Gas Companies of the United States, to be held in the city of New York, on the 16th day of April next, to consider the importance of organizing a National Association, and the best method and materials for manufacturing gas, and to promote the common interests of the companies and the public. The meeting will convene at "Knickerbocker Cottage," No. 456 Sixth avenue, at 10 o'clock, A. M. This notice, or the certificate of secretary of the companies invited, will constitute you members thereof.

P. E. DEMILL, *Detroit, Mich.*
E. T. WATKINS, *Chicago, Ill.*
T. C. MONTGOMERY, *Rochester, N. Y.*

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Accordingly,

At 10 o'clock, A.M., at Knickerbocker Cottage, New York.

April 16, 1873.

On motion of Mr. DeMill, of Michigan, Gen. Charles Roome was called to the chair.

Prof. Henry Wurtz was appointed Secretary.

Mr. DeMill stated the object of the call as set forth in the above circular.

For the governance of this meeting, were adopted provisionally the ordinary parliamentary rules.

On motion of Mr. DeMill, the roll was called of the names of gas-light companies and officials thereof, from whom favorable replies to the above circular had been received. Of these, the following were present and answered the call:

NEW YORK.

Manhattan Gas-Light Co. .	Gen. Chas. Roome.
Harlem Gas-Light Co. . .	John Balmore.
Syracuse Gas-Light Co. .	A. C. Wood, Gen. Leavenworth.
Oswego Gas-Light Co. . .	Wm. Cartwright.
Buffalo Gas-Light Co. . .	O. G. Steele.
Hudson Gas-Light Co. . .	Gen. Chas. Roome.
Peekskill and Catskill Gas-Light Co. . .	G. T. Sutton.
Waterford and Lansingburg Gas-Light Co. .	J. C. House, Wm. Humphrey.

MASSACHUSETTS.

Worcester Gas-Light Co. .	F. C. Sherman.
Springfield Gas-Light Co. .	George Dwight.

NEW JERSEY.

Paterson Gas-Light Co. .	J. R. Floyd.

PENNSYLVANIA.

Harrisburg Gas-Light Co. .	Abram Myers, L. H. Richards.
Philadelphia Gas-Light Co. .	T. R. Brown.

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VIRGINIA.

Petersburg Gas-Light Co. .	W. H. Baxter.

FLORIDA.

Jacksonville Gas-Light Co. .	M. Bowes, H. H. Hoeg.

OHIO.

Cleveland Gas-Light Co. .	Wm. H. Price, J. H. Morley.
Toledo Gas-Light Co. . .	J. H. Whitaker, G. Spencer, C. R. Faben.

MICHIGAN.

Detroit Gas-Light Co. . .	P. E. DeMill, Sam'l Lewis, W. H. Williams.

TENNESSEE.

Nashville Gas-Light Co. .	J. H. Kendrick, S. Prichitt.

DELAWARE.

Wilmington Gas-Light Co. .	Geo. Richardson, J. Bringhirst, Thos. Curley.

KENTUCKY.

Louisville Gas-Light Co. .	Benj. Rankin.

DISTRICT OF COLUMBIA.

Washington Gas-Light Co. .	G. A. McIlhenny.

CALIFORNIA.

Sacramento Gas-Light Co. .	W. W. Goodwin.

GEORGIA.

The Augusta Gas-Light Co. .	Wm. Helwin.

On motion of P. E. DeMill, Esq., of Michigan:

Resolved, That it is deemed expedient to organize a National Association of companies and individuals engaged in supplying cities and towns with illuminating gas. Adopted.

The President read a rough draft of a Constitution, handed in by Mr. DeMill, as a basis for discussion. O. G. Steele, Esq., of Buffalo, moved the appointment of a

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Committee on Organization, of six members and the President, to draft a Constitution. Carried.

The President appointed the following gentlemen as such committee:

Gen'l Leavenworth, of Syracuse, N. Y; O. G. Steele, Esq., of Buffalo, N. Y.; Geo. Dwight, Esq., of Massachusetts; Wm. H. Williams, Esq., of Michigan; Wm. H. Price, Esq., of Ohio; H. H. Hoeg, Esq., of Florida.

Mr. DeMill moved that the different suggestions that had been offered be referred at once to this committee, to report as soon as practicable. Carried.

A recess was taken until 2 o'clock, P. M., in order to allow the committee to deliberate.

2 o'clock, P. M.

The meeting was called to order, and the Constitution, as drafted, was read and discussed.

After some discussion and amendment, the Constitution was accepted and adopted.

Gen'l Leavenworth moved the appointment of a committee of one member from each State, selected from the companies represented, to nominate officers for the Association. Carried.

The President announced the committee as follows:

Massachusetts, Mr. Dwight; New York, Mr. Steele; New Jersey, Mr. Floyd; Pennsylvania, Mr. Myers; Virginia, Mr. Baxter; Ohio, Mr. Morley; Tennessee, Mr. Kendrick; Kentucky, Mr. Rankin; District Columbia, Mr. McIlhenny; Michigan, Mr. Lewis; Florida, Mr. Hoeg.

The committee withdrew to deliberate.

Gen'l Leavenworth moved that the Executive Committee be requested to report a code of By-Laws for submission to the first annual meeting of the Association. Adopted.

Mr. W. H. Williams offered the following:

Resolved, That the President be requested to appoint a committee of three members to consider the subject of

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statistics, and to report a plan or form to be sent to the various companies, the information to be obtained to be printed in pamphlet form for their use, and that of persons connected with gas interests, the number not to exceed 500 copies. Carried.

The President appointed:

Mr. Price, of Ohio; Mr. Lewis, of Michigan; Mr. Williams, of Pennsylvania.

Gen'l Leavenworth moved that the Secretary be directed to make the necessary assessments to pay the expenses of the Association. Carried.

Mr. Price, of Ohio, moved that Gen'l Leavenworth be appointed a committee of one to arrange the Constitution for engrossment. Carried.

Mr. Williams offered the following:

Resolved, That the President be requested to appoint a committee of three members to consider the subject of insurance, and report a plan by which the insurance interests of gas companies can be better protected. Adopted.

The same committee as above (on statistics) was appointed, Messrs. Price, Lewis and Williams.

The Committee on Officers of the Association returned and reported. Their report was accepted and adopted, as follows:

For President, Charles Roome, of New York; for First Vice-President, P. E. DeMill, of Michigan; for Second Vice-President, W. H. Price, of Ohio; for Third Vice-President, Thos. R. Brown, of Pennsylvania; for Secretary, Henry Wurtz, of New York; for Treasurer, J. W. Smith, of New York.

Executive Committee: O. G. Steele, Buffalo; James Howe, Brooklyn; Geo. A. McIlhenny, Washington; E. W. Leavenworth, Syracuse; Charles W. Mowton, New York, with the President and Vice-Presidents *ex officio*. Auditors: Oscar Zollikoffer, New York; A. W. Brown, Philadelphia.

Gen'l Roome returned, with much eloquence, to the

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representatives of the gas fraternity assembled, his thanks for his election as President of the Association.

Mr. DeMill moved that the first annual meeting of this Association be held in the city of New York, on the third Wednesday in October next. Carried.

Mr. Steele moved that the Secretary prepare a circular to be sent to all the gas companies throughout the United States, embracing a copy of the Constitution, and inviting them to become members of this Association. Carried.

Mr. Lewis moved, that after signing the Constitution, we do adjourn till 10 A. M., April 17. Carried.

April 17, 10.30 A. M.

Adjourned meeting.

The minutes of yesterday's meeting read and approved.

Numerous letters were presented, by Mr. DeMill, of representatives of companies unable to be present.

The Committee on Insurance made, through Mr. Price, the following report:

To the Gas-Light Association of the United States:

The committee, to which was referred the matter of insurance, respectfully report: That they have the subject under consideration, and would state that while they are not prepared to present any definite plan, the subject seems worthy of careful consideration.

It is well known to the members of this body, that within the last few years heavy losses have been sustained by gas companies in the accidental destruction of holders, purifiers and other apparatus. These losses aggregate a very large sum. Had either of them fallen upon a company of moderate resources, the effect would have been seriously felt by its stockholders. These accidents have not been of frequent occurrence; but for that reason, the burden of providing, upon the mutual plan,

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against heavy pecuniary loss, would be small. The amount of capital invested in the business of making and distributing illuminating gas is unknown to your committee, but it is certain that it may be estimated at many tens of millions. An infinitesimal percentage upon the aggregate amount of such capital, would provide a fund adequate to the protection of the companies, saving them against severe losses by fire or explosions. It is believed by your committee, that insurance against loss by the liabilities of our business is not within the scope of the business of insurance companies, as now organized, nor is it desirable that such companies shall undertake the kind of insurance alluded to in the report. If it should be deemed well to attempt a system of protection against the losses to which gas companies are exposed, we are inclined to believe that a special bureau of insurance might be organized under the auspices of this Association, and that eminent success might be obtained by such system of mutual protection. We recommend further investigation, with a view to a more full report at the annual meeting in October next, and that a committee be appointed to that end.

Respectfully submitted,

WILLIAM H. PRICE,
SAM'L LEWIS,
WILLIAM H. WILLIAMS.

Accepted and adopted, and the committee requested to report further at the first annual meeting next October.

The Committee on Statistics reported.

Mr. Wood moved that it be referred to the Executive Committee to report at the October meeting. Carried.

12.15 P. M.

The Executive Committee then went into session. Present: the President, Messrs. Price, Steele, McIlhenny and DeMill.

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The following preamble and resolutions were offered and adopted :

WHEREAS, This Association has been formed by those practically interested and engaged in the manufacture and distribution of illuminating gas, for the purpose of obtaining the most thorough knowledge of the best materials to be used, and the most efficient modes of manipulating such materials, the most economical system of conducting the whole business, to the end that the great demand for more *light*, *better light* and *cheaper light* may be met; and,

WHEREAS, No code of by-laws has yet been adopted; now, for the purpose of forwarding the work of this Association,

Resolved, That the Chair appoint the following temporary committees, to report upon the subjects indicated in the following programme :

First. Committee upon the Coals suitable for Use in Manufacturing Gas. Appointed on this committee: Gen. Roome, Professor Wurtz and Mr. Price.

Second. Committee upon the Claims of Crude Petroleum and its Products, as materials to be used wholly or in part in the manufacture of gas. Committee appointed : Messrs. C. V. Smith, Steele and DeMill.

Third. Committee upon the Best Methods of Purification. Appointed: Messrs. Mowton, McIlhenny and Balmore.

Fourth. Committee upon the Best Method of Conducting the Office Business of Gas Companies, viz., keeping accounts, collecting bills, etc. Appointed : Messrs. Price, Steele and C. B. Bailey, of Washington.

The following gentlemen, distinguished in different specialties, were then invited by the Executive Committee to deliver discourses or lectures at the first annual meeting in October, on such subjects as they may severally select :

Mr. McIlhenny, of Washington, D. C.; Dr. J. Lawrence Smith, Louisville, Ky.; Mr. Smedberg, San Fran-

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cisco, Cal. ; Mr. Williams, Philadelphia, Pa. ; Prof. Wurtz, New York.

The Executive Committee made a report. Accepted and adopted.

Mr. DeMill moved that the Secretary be authorized to procure a book for records, stationery and other incidental articles for the use of his office, and the President be and is hereby authorized to audit and the Treasurer to pay the same. Carried.

By Mr. McIlhenny :

Resolved, That the thanks of this Association are due to General Charles Roome, for the ability and dignity with which he has presided over the meeting. Carried.

Adjourned to meet in general session on the third Wednesday in October, 1873, at 10 A. M., at such place as shall be designated by the President.

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FIRST ANNUAL MEETING

OF THE

ASSOCIATION.

MASONIC HALL, NEW YORK,
October 15, 1873.

This being the place selected by the President, and the time, as per adjournment of the meeting in April last, for the first annual meeting of the Gas-Light Association of the United States, and the hour having arrived, the first Vice-President, P. E. DeMill, of Michigan, called the meeting to order.

The Secretary called the roll of the companies, and the following answered to their names:

New York: Buffalo, Oswego, Yonkers, Rochester, Brooklyn, Irvington, Syracuse, Lansingburg, East Chester, Metropolitan Gas-Light Company, Citizens', Brooklyn; Tarrytown, Waterford, National Gas-Light Company. *Delaware:* Wilmington. *Kentucky:* Louisville. *Pennsylvania:* Pittsburg. *Georgia:* Atlanta. *Ohio:* Cleveland, Columbus, Youngstown. *California:* Sacramento. *New Jersey:* Trenton, Paterson, Newark. *Michigan:* Adrian, Detroit, Coldwater. *Indiana:* New

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Albany, Indianapolis. *Illinois:* Chicago, Rockford. *District of Columbia:* Washington.

The Secretary made his report, which embraced also receipts and disbursements.

Fifty-four companies had paid.....	$540 00
And that there had been expended for printing, stationery, stamps, envelopes, record book and salary of Secretary (6 mos.).....	514 00
	$26 00

The report was accepted and adopted.

Mr. E. T. Watkins, of Chicago, moved the Association resolve itself into a Committee of the Whole, to consider the expediency of continuing this organization, which was carried.

The President called Geo. W. Parsons, Esq., of Rochester, to the chair.

In order to test the question as above suggested, a motion was made that the organization of this Association be dissolved.

All the members took interest in the question, and a free, full and very interesting debate was had by the committee.

The vote being taken on the motion to dissolve the organization, it was negatived by a unanimous vote, and the Chairman instructed to report the action of the committee to the Association.

The committee then arose.

The President having resumed the chair, the committee reported through their chairman as instructed. The President then put the question to the Association to confirm the action of the Committee of the Whole, and the Association adopted the report of the Committee of the Whole unanimously, and the President declared the report of committee adopted.

The Executive Committee, through Mr. Price, of Cleveland, made a report on subjects referred to them:

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On Statistics: That in the judgment of this committee, it is not expedient for this Association to entertain the subject-matter of this paper at this time.

The report of the committee was adopted.

The committee asked and obtained further time to report on the subject of by-laws.

Mr. Lewis, of Michigan, moved that a committee of five be appointed by the Chair, to nominate officers for the next year. Carried.

The Chair appointed as such committee the following gentlemen: Samuel Lewis, of Michigan; E. T. Watkins, of Illinois; B. Rankin, of Kentucky; J. H. Morley, of Ohio; James Howe, of New York.

The committee retired for consultation; during the absence of the committee a very interesting discussion was had on the subject of naphthaline, its formation and prevention. The debate was instructive to the Association; participated in by Messrs. Parsons, Nettleton, Price, W. H. White and Herzog.

The committee to nominate officers returned, and, through the chairman, nominated the following gentlemen: for President, Charles Roome, New York; for First Vice-President, P. E. DeMill, Michigan; for Second Vice-President, Wm. H. Price, Ohio; for Third Vice-President, E. T. Watkins, Illinois; P. E. DeMill, of Michigan, for Secretary and Treasurer. The report was adopted.

The President declared the persons nominated by the committee unanimously elected to serve the ensuing year. On motion of Mr. Helwin,

Mr. Herzog, of the Metropolitan Gas-Light Company of New York City, was requested to give a paper at the meeting of the Association in Cleveland, Ohio, in May next, on the subject of naphthaline in gas. Carried.

Wm. Henry White, Esq., of the Citizens' Gas-Light Co. of Brooklyn, then made extended remarks upon the use of naphtha gas, an enricher to the coal gas, as in operation at the Citizens' works under his charge in

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Brooklyn, in connection with hydrogen gas made under the Gwyn Harris patents.

Mr. Price, of Cleveland, Ohio, called out many very strong points made by Mr. White upon the unsettled question in the use of this material as an enricher or improvement over the manufacturing of gas from coal exclusively.

Mr. Nettleton offered the following resolution:

Resolved, That the thanks of this Association be tendered Mr. White for his exposition of the method of using naphtha at the Citizens' works in Brooklyn, as an enricher of coal gas, under the Gwyn Harris process. Carried.

George A. McIlhenny, Esq., of Washington, D. C., made remarks on the accumulation of carbon in clay retorts.

Moses Combs, Esq., of Youngstown, Ohio, gave his experience in the use of a water jacket around the stand pipes to prevent stoppage of the same.

Mr. Nettleton gave his views of an apparatus in which are combined the functions of exhauster, condenser and scrubber with good results.

The Convention took a recess until 9 o'clock, A. M., Oct. 16th.

9 o'clock, A. M., Oct. 16, 1873.

The Association was called to order by the First Vice-President.

The roll of members was then called, and the following companies answered to their names:

A. C. Wood, Syracuse, N. Y.; O. G. Steele, Buffalo, N. Y.; Wm. Cartwright, Oswego, N. Y.; G. T. Sutton, Peekskill, N. Y.; T. C. Cornell, Yonkers, N. Y.; J. Herzog, New York City, N. Y.; W. H. White, Brooklyn, N. Y.; H. P. Allen, New York City, N. Y.; George W. Harris, New York City, N. Y.; George W. Parsons, Rochester, N. Y.; Charles Nettleton, East Chester, N. Y.; J. W. Beatley, Brooklyn, N. Y.;

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James Howe, Brooklyn, N. Y.; J. C. House, Brooklyn, N. Y.; E. T. Watkins, Illinois; T. Butterworth, Illinois; T. C. Hopper, Wisconsin; George Richards, Delaware; Joseph Bringhirst, Delaware; J. H. Morley, Ohio; W. H. Price, Ohio; A. B. Robinson, Ohio; M. Combs, Ohio; P. E. DeMill, Michigan; Samuel Lewis, Michigan; R. M. Wilder, Michigan; W. H. Williams, Michigan; J. Webster, Michigan; Wm. Helwin, Georgia; G. A. McIlhenny, D. C.; W. W. Goodwin, California; E. Vanderpool, N. J.; J. C. Chambers, N. J.; J. Williams, N. J.; H. Stacey, Indiana; B. Rankin, Ky.; P. D. Hostetter, Pennsylvania; H. Cartwright, Connecticut.

The Secretary read proceedings of previous day. Adopted.

The Chairman then announced that by the action of the Association, he having been elected its Secretary, he resigned the duties of the Chair to the Second Vice-President, W. H. Price, Esq., of Ohio, and invited him to preside over the further deliberations of this body.

Mr. Price then came forward, and in a few appropriate remarks assumed the duties as presiding officer of the Association.

Reports of committees being in order, Samuel Lewis, Esq., of Michigan, stated that the committee to whom was referred the subject of insurance had not been able to submit a report at this time, and asked to be discharged, and the whole subject be referred to Wm. H. Williams, Esq., of Pennsylvania, to report at the next meeting of the Association. Carried.

Mr. Helwin offered the following resolution:

Resolved, That a committee of three, consisting of Messrs. White, of Brooklyn; Henry Cartwright, of Connecticut, and T. C. Cornell, of New York, be a committee to prepare a report of the proceedings of this meeting for publication in the *Gas-Light Journal*. Carried.

The Chairman called G. W. Parsons, Esq., of Rochester, to the chair, and submitted several amendments to

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the Constitution for the consideration of the Association, which were approved and ordered printed.

Samuel Lewis, Esq., of Michigan, moved that when this Association adjourn, it adjourn to meet in the city of Cleveland, Ohio, on the second Wednesday of May next, 1874, it being the semi-annual meeting as per amended Constitution. Carried.

The Committee of Finance moved the account of the Treasurer be allowed and paid. Carried.

On motion, the Association adjourned *sine die.*

P. E. DEMILL,
Secretary.

GAS-LIGHT ASSOCIATION OF THE UNITED STATES.

Proceedings of the second Semi-Annual Meeting of the Gas-Light Association of the United States, held in Cleveland, May 13, 1874.

In the absence of the President, General Roome, of New York, the meeting was opened with the following words by Mr. P. E. DeMill, of Detroit:

Gentlemen: The time has arrived for which the meeting has been called, and the Association has honored me with two other offices besides that of Vice-President, the duties of which will require all my time. I therefore call Mr. Price, of Cleveland, the Second Vice-President, to the chair.

Mr. W. H. Price then took the chair, and spoke as follows:

The Association will please come to order. I presume no one will regret more than myself, that our accomplished President is absent; he has not returned from Europe. I also regret that Mr. DeMill is so engaged that he cannot take charge of the Presidency and conduct your deliberations; but relying upon your forbear-

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ance, I will endeavor to do as well as I can in this position.

This Association has grown out of a necessity which has been felt, and which arose mainly from the fact that there is a very great dearth of educated gas engineers and gas managers in this country. We have no schools, no associations, no arrangements made by which that body of men which is called upon to build and to manage gas works, can be educated. Nearly all of us, I presume, have come into this specialty in a certain sense accidentally. I presume we have present with us some who have been educated to the profession; but I speak in general terms. It has been long felt to be a necessity that we should associate together for the purpose of combining what knowledge and what experience we have acquired in perfecting ourselves in the art and science of making and distributing illuminating gas. This Association is entirely and strictly for mutual improvement, and has no other purpose. As the cities and towns of this country have grown and developed, gas companies have been organized, and now no town having a sufficient size or sufficient population, can afford to do without gas works. Nearly every little town in the Northern, and many of the Southern States, is supplied with gas companies and gas works. This interest has become large, and it seems necessary that it should be developed in the best possible manner; and this can only be done by meeting occasionally and comparing our views, our theories, and experiences We are all confronted at every step by difficulties. The gas manager lives too much isolated. Nearly all of his time he is confined to his works. He travels too little, learns little of the experience of others, and hence he is very apt to run in the rut in which he started. Perhaps the party who first built the works gave it a certain cast, a certain direction, and year after year it runs in that same rut without making any expansion.

Now this society has been organized to get ourselves

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out of all ruts; to learn what are the best methods of construction, and the best methods of applying labor and manipulating material, so as to give our towns and cities the best quality of gas at the lowest price.

We are constantly assailed by those who wish to sell us patents to revolutionize the whole system of gas-making. While on the one hand we should not shut our eyes to all proper improvements, yet on the other hand we should be careful not to take in at once everything that is claimed to be an improvement. We have associated together for the purpose of carefully discussing and investigating the claims of these different improvements. Many of them are old and have been two or three times exploded, but are occasionally revamped and brought forward.

When this Association was organized it was on a broad basis. It was to consider all claims of materials to be used, and the best methods of using them. I hope we have come together in a liberal spirit, and with a determination to sit here long enough to listen to the articles that have been prepared, and to engage in the discussions which shall grow out of them, and to gather up as much as we can of experience and knowledge, to be used in the interest of our companies at home.

I do not propose extended remarks. This position has been assigned me very unexpectedly; and without detaining you longer, I now announce the meeting opened and ready for business.

The minutes of the last annual meeting were then read by the Secretary and approved.

Mr. Hickenlooper said: Without being familiar with the early proceedings of the Association, and without hearing anything in the minutes to enlighten me on the subject, the matter would very properly come under the order of general business; but under the order of business you have established, I would ask whether there has been any rule decided upon as to the eligibility of members of the Association. The Constitution

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provides that gas companies in their corporate capacity, or individuals engaged in the supplying of towns and cities with gas, are alone eligible to membership. I desire to know whether members of the profession are eligible as members of the Convention.

The President—In reply to the remarks of General Hickenlooper, I will say while it is true that the Constitution provides that gas-light companies shall constitute this Association, it also provides that individuals engaged in the business of making and distributing gas to cities and towns, may also become members, whether they are acting under a corporation or not; and it is also true that each gas-light company being a member of this Association, is entitled to three delegates in the meeting. They may send their engineer, their president, or any of their directors, or any of their stockholders if they please; so that, in that sense, where any person holds such a relation to a gas company, he is entitled to membership, or at any rate, to sit in the Association as a representative member.

Mr. Hickenlooper—Mr. President: I am peculiarly situated, probably differently from many of the gentlemen present—that is, I am not here as a representative of a gas company; I have no authority to do that. I am simply an officer or employee of that company, and as such, to them my services are more or less valuable. If I can improve the value of my services, it is for their benefit—of course if I cannot perform my duties to their satisfaction, they will find somebody else who can. I act for them individually, but by virtue of my employment. Now, the Constitition says that the membership of the Association shall consist of the several organized companies, and all individuals engaged in supplying cities and towns with gas. I am neither of these. It appears to me that the English association is a little different in its construction from your Gas-Light Association—that its membership consists of engineers and members of the profession. Now, I suppose, the present is not a proper

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time to discuss this matter, nor do I know that the Convention have any disposition to do it; but, under this strict construction of the Constitution, I would certainly be ruled out, and it appears to me, that instead of gas-light companies, it should be officers or employees, or the superintendents or managers of a regularly organized gas company; but I will waive the point now until it comes up under the general order of business.

The President—Perhaps literally and closely interpreted, the Constitution would not cover your case, but I think it is not stretching the Constitution very much to say that it is perfectly proper for you to sit here as a member of this Convention, and as a member of this Association. When the Constitution of our Association was adopted, we had a great deal of trouble about this same question, and we had the same trouble at the annual meeting in October—it is pretty difficult to adjust the membership precisely. On the one hand we were unwilling to confine the Association simply to those who would only act in the scientific capacity, and who were mainly engaged in the business of construction. We wished to include the financial and managing talent of gas companies as well—on the whole it was thought best to organize as we did. I know there are difficulties attending it. Of course every one would be very glad to have General Hickenlooper attend this Convention, be a member of it, act with it—and I think the difficulty may be entirely overcome by inviting all persons sitting to become, for the time being, corresponding members, or honorary members perhaps, not strictly entitled to vote, at the same time contributing their portion of intelligence and experience to the common stock. I shall be very glad to hear suggestions.

Mr. Nettleton—Mr. President: It is my understanding that at the discussion we had at the last annual meeting, this question had been settled by the Convention—that any gentleman who presented himself from any company, or gas works, would be permitted to

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come into the Convention, and would be desired to take part, and vote, provided no more than three from any gas works were admitted.

The President—What is the understanding of other gentlemen who were present in New York at the meeting in October?

Mr. Hickenlooper—If this was the feeling of the Association, it appears to me it should be expressed in a more emphatic way; that if intended to include the treasurer, president, vice-president, secretary, superintendent and manager, it can be expressed in words. Now any action which may be taken by the representatives of a company here cannot affect that company. They are not interested in the affairs of this Association, they employ talent and they pay for it. Their board of directors engages a man to perform certain services; if he does not possess the ability they find somebody who does. My company is not interested in anything this Association does at all. They don't care whether a process is improved, or whether it is not improved. They employ men to perform that service, and the very moment they fail that moment their heads are taken off, and they find some one who can. It is not information you can communicate to a corporated body, but to the men who perform labor for the company, to render their services more or less valuable.

The President—Of course it is scarcely worth while to go into any general discussion of our Constitution. We have already spent a great deal of time over that, but I hope some arrangement will be made by which the gentleman will become a member of the Association, and that we shall have the benefit of his experience and suggestions, and at the same time be able to go forward without undertaking at present to change the Constitution; but a committee might be appointed to revise the Constitution and make amendments to be acted upon at the next meeting.

Mr. Hickenlooper—I suggest that the matter be de-

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ferred until the consideration of general business. Agreed.

The Secretary then called the roll, and the following gentlemen responded to their names:

F. C. Sherman, Worcester, Mass.; George Dwight, Springfield, Mass.; W. B. Brooks, Dorchester, Mass.; T. I. Pishou, Roxbury, Mass.; H. Cartwright, Bridgeport, Conn.; E. W. Leavenworth, Syracuse, N. Y.; A. C. Wood, Syracuse, N. Y.; O. G. Steele, Buffalo, N. Y.; W. Henry White, Brooklyn, N. Y.; Charles Nettleton, Mount Vernon, N. Y.; W. H. Grenelle, Brooklyn, N. Y.; J. R. Floyd, Albany, N. Y.; L. C. Kingsbury, Corning, N. Y.; C. S. Cole, Corning, N. Y.; J. McDougall, Dunkirk, N. Y.; A. J. Avery, Dunkirk, N. Y.; W. W. Hague, Kingston, N. Y.; W. L. Williams, Paterson, N. J.; R. Beachem, Columbia, Pa.; W. H. Dennison, Pittsburg, Pa.; L. H. Severence, Titusville, Pa.; Thomas Curley, Wilmington, Del.; Geo. A. McIlhenny, Washington, D. C.; Thomas Turner, Charleston, S. C.; Geo. S. Hookey, Augusta, Ga.; W. H. Price, Cleveland, Ohio; G. A. Hyde, Cleveland, Ohio; J. H. Morley, Cleveland, Ohio; Joseph Clegg, Dayton, Ohio; Joseph Light, Dayton, Ohio; A. B. Robinson, Columbus, Ohio; H. W. Miller, Columbus, Ohio; E. McMillin, Ironton, Ohio; E. Printz, Zanesville, Ohio; John Bousfield, Cleveland, Ohio; E. Lindsley, Cleveland, Ohio; B. F. Reinmund, Lancaster, Ohio; J. C. Buxton, Springfield, Ohio; A. Hickenlooper, Cincinnati, Ohio; M. Combs, Jr., Youngstown, Ohio; W. H. Williams, Chicago, Ill.; William Dunbar, New Albany, Ind.; J. F. Marsh, La Porte, Ind.; P. E. DeMill, Detroit, Mich.; R. M. Wilder, Coldwater, Mich.; J. J. Tucker, Flint, Mich.; J. C. Sterling, Monroe, Mich.; Joseph Hendley, Beloit, Wis.; James H. Walker, Milwaukee, Wis.; R. Spencer, Burlington, Iowa; H. H. Sibley, St. Paul, Minn.; W. W. Goodwin, Sacramento, Cal.; Thomas Rankin, Louisville, Ky.; F. W. Gates, Hamil-

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ton, Canada; Thomas Littlehales, Hamilton, Canada; H. Thompson, Toronto, Canada.

The President—I wish to call the attention of the Convention to the fact that several gentlemen from Ontario, on the other side of the lakes, are present, who are practically engaged in making and distributing gas, and perhaps, strictly speaking, our Constitution does not enable them to become members of the Association. I hope we may devise some way by which they can act with us.

Mr. Nettleton—I move, Mr. President, that the gentlemen referred to be invited to sit with the Convention and participate in all its proceedings, except voting.

Mr. Sibley—Would it be proper to elect them as honorary members?

The President—That we cannot do; but we can invite them to sit at this Convention, and then submit the whole matter to a committee to revise the Constitution so that they can be brought in properly.

Mr. Hickenlooper—Mr. President: Is there any provision in the Constitution for electing honorary members?

The President—There is no specific provision, but I suppose it is the common law of any organization.

Mr. Hickenlooper—I do not believe it is. I hope this matter may go to some committee. Some gentlemen desire that a committee should be appointed for the purpose of considering amendments to the Constitution, let that provision be also considered by them.

Mr. Spencer—It might be well that the provision should also embrace persons on this side of the lakes, and settle this question of membership heretofore discussed, for the present.

The motion of Mr. Nettleton was then adopted.

Mr. Gates—Mr. President and gentlemen of the Convention: We heartily thank you for the honor you have done us in permitting us to participate in your deliberations.

The President—I think I may say we are very happy

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to welcome our friends from the other side of the lakes, and we hope to be benefited by the information and experience which they may bring to us.

The next matter in order is the report of the Executive Committee.

No report.

The Secretary then read letters from the following gentlemen: Prof. Henry Wurtz, Hoboken, N. J.; Prof. J. Lawrence Smith, Louisville, Ky.; George W. Parsons, Rochester, N. Y.; E. T. Watkins, Chicago, Ill.; J. R. Smedberg, San Francisco, Cal., and J. Herzog, N. Y..

The Treasurer (Mr. DeMill) then made a report as Treasurer of the Association, which was referred, on motion, to Messrs. Steele and McIlhenny as Auditing Committee, to report to the Convention.

The President—About two weeks since I was shown a letter by a member of this Association, which struck me very favorably, suggesting that there should be something like a banquet during the session of the Convention; that the Convention should meet socially around some board, to be provided in this city, and I wrote to Mr. DeMill that I thought it a very excellent idea, but that I did not see very well how we could provide for any specific number, for we did not know how many would be present, and that it would be best to decide upon it after the Convention should assemble. In order to have that thing accomplished, if it meets the approval of the Convention, it is desired that we take some action now. If the movement meets with the favor of the Convention, it will not be very difficult to get up a plain, pleasant banquet to which we can do justice, I presume.

Mr. Cartwright—I would ask whether we would be guaranteed exemption from the crusaders?

The President—I wrote Mr. DeMill, that in view of the present state of public sentiment in Cleveland, it would be necessary to exclude all wines and liquors. (Laughter.)

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Mr. White—Mr. President: I object to the elimination of wines from banquets.

Mr. McIlhenny—Mr. President: We have some gentlemen among us here who are members of the New England Association of Gas Engineers, and I would like to hear from them.

Mr. Sherman—A very pleasant part of the business of our Association is the banquet. We should feel very much lost if we did not have a chance to enjoy social intercourse together. I think no one would regret having such pleasant intercourse as we might have on such an occasion.

Mr. Hickenlooper—I think Mr. Sherman has failed to enlighten us on the most essential point, as to the custom of his association in the use of intoxicating liquors at its banquets.

Mr. Sherman—If the gentleman should come down there, he would see what we have to drink.

Mr. McIlhenny—I will state that I had the pleasure of attending one of the meetings of that association, last August, at Portland, and the main feature of the meeting was the banquet. I must say that the intellectual part did not strike me as being very forcible; but the banquet certainly struck me with a good deal of pleasure. They all enjoyed themselves very much, and had a very cheerful time, and on the excursion down the bay had plenty to eat and drink, and of the best quality—a jovial time—and we all went home very much satisfied with the trip. Now, if we do not get an intellectual treat you certainly want a sort of physical remuneration for your trouble, time, etc.

The President—The letter I refer to was written by Mr. McIlhenny, and it struck me very favorably. Of course the great point is the intellectual feast: but it seems to me if we could have a supper, not an extravagant, not a drunken supper by any means, but a good sensible supper, it would be a very pleasant thing, and would bring us all socially together better than in any

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other way. The Convention would perhaps like to hear from Mr. Steele, and other gentlemen, on the subject.

Mr. Steele—If I wanted to drink I would like to have the chance. I would suggest that the whole matter be referred to the President with power.

The President—I should object to having it referred to me alone.

Mr. Walker—Mr. President: I move that we *do* have a supper, and that a committee be appointed for that purpose.

Mr. Spencer—I don't know whether we have time. If we are to have a supper, are we to have it to-night, or to-morrow night, or the latter part of the week, or *when* is it to be? A question not determined yet is, whether this Convention will hold its sessions longer than to-day; if it will not, we had better have the supper to-night, if at all. If the meeting adjourns to to-morrow evening, those of us who live a good ways off will probably be inclined to take the night train home; and the trains leave too early to go after supper, and some of us may not be in a condition after supper to go anyhow: so I think it is a question for this body to consider whether we have time to engage in a banquet on this occasion; if so, when is it to be?

The President—My impression is, if it is to be had at all, it must be had this evening. Of course we will endeavor to do all the business we can this afternoon, and if we adjourn over to-morrow, I presume it will be impossible to keep the members all here to-morrow.

Mr. Hickenlooper—I would suggest that the consideration of this matter be postponed, and in lieu thereof, have the banquet at each annual meeting.

Mr. Walker—I move that the Chair appoint a committee to report after the recess, as to the expediency of having a banquet.

Mr. Floyd—For the purpose of getting the sense of the Convention upon the question at once, I move that we have the banquet this evening.

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Mr. Walker—I withdraw my motion.

The motion of Mr. Floyd to hold a banquet was lost.

The President—There has been a Committee on By-Laws appointed. We have no by-laws. I would like to know whether that committee is prepared to report. Who are the committee?

Mr. DeMill—That I do not know, but there was a committee appointed on by-laws at the first meeting; and by-laws are essential and necessary to carry out your Constitution, as it does not seem to be wholly understood by the gentlemen from Cincinnati. I think some of the gentlemen here are on that committee, and must recollect being appointed, and can say whether they are prepared to make a report or not.

The President—I remember distinctly that there was a committee appointed, but I do not remember the names of the committee. It was appointed at the organization of the Association; and I venture to say no report has ever been proposed. I think we may fairly consider that committee has lapsed, and a new committee should be appointed. The Secretary says he knows of no record of any such committee.

Mr. McIlhenny—I move we have a committee to draft by-laws.

The motion was carried.

Mr. Williams, of Chicago, then presented his report on insurance.

Mr. DeMill—I think this matter of the report on insurance is of very great importance, and one that deserves from this Association a great deal of earnest consideration. It does not ask anything of the Association; it simply submits a principle, and I should like to have it referred to a committee to report at our meeting.

The President—I have not the slightest idea of giving this report the go-by in any way whatever; but it seems to me to be an important question, whether this Association should embark in the business of insurance. It certainly should be read and discussed before it is referred. If the Convention wish, it may be read.

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Mr. Hickenlooper—I move that the report be laid on the table, and that the Chair appoint a Committee on By-Laws, to report to-night. We had better do one thing at a time.

The Chair appointed Messrs. Nettleton, Sibley and Steele upon the Committee on By-Laws.

The report of Mr. Williams, on insurance, was then read by the Secretary.

Mr. DeMill—We can now see how cheaply we can protect ourselves. We insure to the amount of $30,000 and more, and we pay a premium of $300, and it could be done for one-third of the money under this plan, and the company would be very glad to avail itself of some such organization. It has a great deal of property that cannot be insured.

Mr. Cartwright—I move that the paper be received and placed on file for future reference, in case the subject of insurance should be taken up for future action. Carried.

Mr. Cartwright—I would move that the thanks of this Convention be tendered to Mr. Williams for his labors in this direction. Carried.

On motion of Mr. Sibley, the Convention took a recess until 2 o'clock, P. M.

Afternoon Session.

The Secretary (Mr. DeMill) being absent, Mr. Hague was elected Secretary *pro tem.*

The President—The next business before the Convention is reading of papers.

Mr. Steele—I would state, gentlemen, that I was requested by Mr. DeMill to prepare a paper for this occasion. I am not a gas engineer nor constructor; but I have had a good deal to do with the management of gas works, and what I have to say is merely some suggestions in the way of experience which I hope you will consider as my part of duty on this occasion.

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The Management of Gas Works.

By Oscar G. Steele, Secretary and Superintendent of the Buffalo Gas-Light Company.

I have been requested to prepare a paper on some subject connected with the objects of this Association to be read at this meeting.

I will make an attempt to do so, and regret that I cannot address you upon that portion of the declared objects which relate to construction and manufacturing.

My connection with the business of gas-making has been of a business character only. I am not a gas engineer, know little of the science of construction, or of manufacturing, except as incidentally acquired during a quarter of a century connection with the business department.

My position has been that of a gas company manager, and to this department I shall mainly endeavor to confine my remarks.

My connection with the gas business arose from circumstances which might occur with any party.

When the subject was first agitated in our city, which was in 1847, I became interested in it as a great public improvement. The business was very little known in our State. New York had been supplied for some years, and Albany for a very short time. The movement to erect gas works was looked upon with little favor as a business enterprise, although all appeared anxious to have it succeed, as a matter of public convenience and personal luxury. But, notwithstanding the general desire to have the city supplied with gas, and the streets lighted, few individuals were disposed to invest their money in what appeared to be so doubtful an experiment.

After great effort, a sufficient amount of stock was taken to justify the proprietors of the enterprise in going on with the works, although it was scarcely one-

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fourth of the amount necessary to complete them, ready for the transaction of business.

The chief motive for proceeding with the enterprise was public spirit, an earnest desire to obtain what was conceded to be a great public improvement. The science of the business, or the expectation of ultimate profit, had little to do with it for several years after its completion.

But a few years changed the relations of the business. The change from the oil, camphene and candles was very pleasant; but the novelty soon wore away. Gas cost money as well as oil and candles, and the same spirit of economy required feeding as before. The gas supply could not be kept up, without regular and prompt pay, a habit which, with a considerable portion of every community, is not easily acquired. And it soon began to be suspected that the public-spirited proprietors of this great public improvement, might possibly be making money out of it. Certainly those parties who risked their funds in the enterprise, had a hope at least, that it might eventually be a paying business. That this result has been reached by most of the gas organizations in the larger cities and towns, is undoubtedly true; but as soon as it was popularly understood to be a success, the profits were greatly exaggerated in the public mind.

From that period in the history of nearly every gas company in the country, the state of public opinion has been such as to render the management of a gas works in a large city, a labor of anxiety, which only those who have been identified with it, can comprehend.

To the average citizen, the gas company was a great monopoly, making and distributing into every household an article which cost nothing, and who were inexorable in demanding pay for it. It mattered but little what the real state of the business was, it was sufficient that pay was demanded, and collected, or the supply would be stopped.

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It never seemed to occur to parties that they still possessed the inalienable right to refuse to use the gas, and fall back upon the ancient and venerable privilege of using oil and candles, nor that even the dealer in oil and candles would also stop the supplies if his articles were not paid for. Nor did it occur to them that they might take the advice of Dr. Franklin to the citizens of Paris, when they complained of the great cost of candles, that they could go to bed at dark and get up at daylight, and thus avoid the intolerable expense of candles, circumvent the wax and tallow chandlers, besides greatly promoting their own health and capacity for industrial pursuits.

The "inherent right to grumble," which we have inherited from our English ancestors, finds ample room for improvement in everything relating to the gas supply. In no other department, except possibly taxes, is there such constant and universal complaint. Many people talk and act as if every penny paid to a gas company was extorted without consideration, and this feeling is without the slightest reference to the price charged for the article. The feeling is just as prevalent where gas is sold at a very low figure, as at a high one. The gas company is denounced all the same.

In England, where the supply of coal, cost of construction, and price of labor, enable the public to have gas at lower rates than in any other part of the world; there is the same chronic fault-finding as in countries where its cost is five times as much.

But great and unreasonable as is this feeling of dissatisfaction, there are many reasons why it should be so. Few people know anything of the detail of the cost of construction of gas works, or of the process and cost of manufacture, and still fewer will take the trouble to investigate it in any respect. It is generally understood that it is made from bituminous coal, which costs from $5 to $8 per ton, according to locality.

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It is also popularly believed that coal will produce from eight to ten thousand feet of gas per ton. The rapid conclusion is that a ton of coal costing five or six dollars, produces $25 to $30 worth of gas, and the difference between the cost of the coal and the market value of the gas is all profit. It may seem strange among men of business that such an impression should exist; but it is quite universal, as every gas works manager must be aware.

Other elements combine to create dissatisfaction. Very few consumers know anything of the principles and working of a gas meter. Their bills vary somewhat for different terms, sometimes very widely, and they cannot understand why it is so. And when it is shown by examination of the meter that the statement is correct, then the accuracy of the meter is questioned. An offer to test the meter under the requirements of law, is usually treated with contempt.

And then the system which must control the gas supply seems to many persons too rigid and arbitrary. The meter is the arbiter between the company and the consumer, and cannot with any safety be varied from. That the instrument is one of the most ingenious, as well as accurate measures ever invented, is well known to those who know its principles and the general accuracy of its work; but when its decisions do not sustain the views of the consumer, there is no language too strong to use in denouncing its infallibility.

That slight variations sometimes occur from improper location of meter, affecting the state of the atmosphere, is conceded; but rarely work against the consumer, and, when shown, are rectified without loss. But still there is the same doubt and mistrust prevailing to an unlimited extent.

All these things have to be met in a cheerful spirit. Nothing is lost by spending time in making explanations to parties disposed to fairly investigate, and it rarely fails to satisfy fair-minded men. But the great body of con-

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sumers still have their doubts and misgivings as to the fairness of the gas supply. The complaints often made partake of a ludicrous character. It is not uncommon for parties to complain that the gas furnished them is inferior to that furnished to their next-door neighbor, and they are obliged to pay the same price for poorer gas. Charges are also frequently made that the gas is diluted, or purposely made poor, to increase registration without increasing light, and so on *ad infinitum*. It is sometimes difficult to meet such contradictory and incongruous complaints, but it is one of the crosses which a gas manager has to bear, and must be met and endured with such Christian philosophy as poor human nature can command. It is an element connected with the business, and those who conduct it must discipline themselves accordingly.

But the general principles of gas supply should be well understood by us all, and we should be prepared at all times to meet freely and manfully the unjustifiable prejudice against us. Let us consider briefly the basis of our business, and the principles which underlie the whole.

In the progress of civilization the use of the night has been constantly encroaching upon that of the day.

In the early ages of the world, day was day, and night was night. As the means of producing artificial light increased, the nights become more used for business as well as amusement, until a large portion of the night was turned into day by the improvements in producing artificial light.

From pine knots to wax candles, was a great advance; but, since in the early part of the present century, the discovery of gas, and its adaptation to every requirement of lighting, were made, all other methods of lighting have been suspended.

It became necessary for manufactories on a large scale to be created, to meet the popular demand. The great expense attending it, made it necessary to com-

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bine capital, by corporate organizations, as was first done in London.

The process of manufacture was, however, very crude, and great losses were incurred before permanent success was reached. This was finally accomplished by skill and perseverance. For some years the business was unprofitable, and only became profitable after great improvements in manufacture and distribution had been effected.

Its great superiority over all previous light, soon brought it into general use throughout England, and has since worked its way into every civilized community.

As improvements were made, and gas came into general use, the profits of the business increased, and soon brought jealousies and competition, which have since been constantly connected with the business.

Every town where it was first introduced, felt that it had made a great stride in providing for public wants and conveniences. But success in a financial way, by the companies, was not so agreeable to consumers.

Non-stockholders feared the companies were making too much, and every obstacle was thrown in their way. The nature of the business is such that progress is inevitable, and companies are obliged to look constantly ahead to provide for public wants. This serious necessity increased the responsibilities of gas companies, and also the prejudices against them. Every scheme which could be devised by jealous or interested parties, is eagerly seized upon to embarrass existing companies, and create by every means an unfair competition. The sympathies of the public are always with every effort at competition or embarrassment to existing companies.

The result has been almost constant warfare, compelling companies to protect themselves as best they could, while new companies, with the popular sympathy, pressed in every way possible, to divide, at least, the profits of the existing companies. Many of these move-

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ments in large cities have been successful to the proprietors, who, in the rapid growth, have made a business for themselves.

But no instance can be shown where the public derived any benefit from the organization of a new and competing gas company. Division of territory or consolidation of interests have been the results in all cases, without permanent benefit to the city or to the citizens. It is not necessary to dwell upon these issues—they will work out for themselves.

The cry of monopoly is kept up persistently, and with some degree of plausibility. Let us look at this subject in the light of experience.

1. Gas companies are manufacturing corporations, for the purpose of making and selling gas to such as desire it, constructing their works and laying pipes, relying for remuneration on their ability to furnish light better and cheaper than by any other method.

2. Gas companies are organized under special or general laws, but have no monopoly, being simply authorized to make and sell gas. New companies can at any time be authorized upon the same territory.

3. No company possesses power to enforce the use of its light, or its continuance by any consumer any longer than is for his own interest or pleasure; and we are subject to competition from every other known method of lighting, or which may hereafter be invented.

4. They are, in short, manufacturing corporations, producing an article of prime necessity at lower rates than any other process; and are dependent for success upon this fact, and the judicious management of their business.

5. A gas works, from its character, is a local institution, and can prosper only by identifying its own interests with that of the community. When once constructed and its pipes laid, it cannot be removed, nor its business changed.

Such are the facts in regard to the status of gas com-

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panies. The charge of monopoly is therefore groundless. With this state of things the duty of managers of gas works is to meet the wants, and even the clamor of interested parties, in a spirit of equal and exact justice to all.

Every precaution should be taken to manufacture and distribute gas of the best quality which can be made from the materials within its reach, and as near as possible of a uniform quality. The street pipes and fitting should be of the most perfect character, for the mutual benefit of company and consumer.

In its supply of meters, which is the basis of all its business, no pains should be spared in obtaining those of the best quality for accuracy and permanency. Its testing apparatus for meters and burners should be perfect, and accessible to every consumer at all reasonable times, that every one can see for himself, if he desires it, the actual condition of meters and burners.

When any one desires an explanation of anything connected with his gas supply, give every attention to his request, concealing nothing from any one who really desires information.

In short—let us in all our dealings with the public, or with individuals, transact our business on business principles, and do right at all times, regardless of injustice done to us. At the same time it is not required of us that we should do this in an apologetic or subservient spirit.

The making and selling of gas-light is just as honorable a business as any other in any community. It furnishes an article which is better than all others to every household and place of business on its lines of pipe, and at prices which command its use for the interest of every party who uses it. If not satisfactory, no one is obliged to continue its use.

This service is entitled to fair remuneration, like all other business. In short—the interests of the company and its customers should be mutual in gas business, as

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in that of all others, where buyers and sellers meet on common ground.

With these principles the business of gas-lighting should be ranked among our permanent industries, and entitled to the same consideration as that of any other legitimate business. By following out strictly these principles of doing business, we shall command the confidence of fair-minded men in all communities, and with which we must endure the attacks of all others.

I think I do not assume too much when I say that the officers and managers of the gas companies, in all parts of our country, are composed of men at least as respectable and honorable as are to be found in any other branch of business. I have had personal intercourse with a large number of gas companies, and correspondence with many more, in this country and in Europe, and I have always found their officers and managers men of character and intellect, and of high moral standing in their communities. Certainly no other profession exhibits less of the demoralization of character in the transaction of general business, than ours.

For this I claim nothing, for every man of any corporation should do right to the community from which it derives its business and patronage; but I do claim that in all the qualities which make good men and good citizens, the officers and managers of gas companies are at least the peers of all others. Let us in the justice and fairness of our business with the public, keep these principles constantly in view in the future as I feel assured we have done in the past.

The President— I am very sure every member of the Association will feel very grateful to Mr. Steele for the very able paper he has read to us.

Mr. Rankin—I move a vote of thanks be tendered to Mr. Steele for his address. Adopted.

Mr. McIlhenny—I desire to qualify a statement that I made before the recess, that the intellectual part of the

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proceedings of the New England Association did not strike me very forcibly. I meant that with regard to the general proceedings at the time, and not to the individuals. At the last meeting of this Association, I promised to submit some remarks upon a subject I have taken a great deal of interest in, and I now comply with promise.

Deposition of Carbon in Retorts and Means of Preventing it.

By George A. McIlhenny, Engineer of the Washington Gas-Light Company, District of Columbia.

Mr. President: The subject on which I propose to make a few remarks, is the deposit of carbon in retorts, and the means of preventing it. This subject, although perhaps the most important connected with the manufacture of gas from coal, has received the least consideration, but I am pleased to say that within the past few years more interest has been, and is being manifested.

The accumulation of carbon as an incrustation on the inside of retorts, commences with the distillation of coal for making gas, and no means has as yet been devised to *entirely* prevent it. Why it is that this subject has not received more attention has often astonished me. It cannot be that it could be forgotten by any manager of a retort house, who gave that part of his duties even a passing notice; because it is ever present, and its growth is a sure crop; it is like a vigorous cancer with regard to its constant growth and certain return. It may be called the pest of the retort house and the torment of the engineer.

When it is removed it is sure to return, and again and again has this process of removal got to be repeated; in fact, it is as much of a duty and custom in some works as to draw and charge the retorts, and almost as important. Why this indifference, apparent

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or real, towards a subject involving so much pecuniary interest? The only way that I have ever been able to account for it is the fact of the difficulties that stared every one in the face, without having the means to overcome them, and the natural tendency of men to shrink from difficulties that they have no reasonable hope of overcoming: and another class of men do not even take the trouble to inquire into this subject, but go on from year to year cleaning out their retorts, simply because it is the custom to do so in other places, and has been in theirs; and if I may be permitted so to say—this practice of carrying the corn to the mill in the manner of our forefathers, is too prevalent in some gas works at the present time. The cause of the deposit of carbon in heated retorts is attributable to the fact, that when bituminous coal is subjected to destructive distillation by heat, it yields a great variety of vapors, and gases composed chemically of carbon and hydrogen; and having each one its particular condensing temperature, or degree of heat at which it changes from the aeriform to the liquid state, some of these having so low a condensing temperature that they remain gaseous when exposed to intense cold, while others require a considerable elevation of temperature to cause them to assume rapidly the condition of a gas; but there is another agency beside heat that can produce the condensation of these aeriform bodies, or make the liquid ones take on gaseous state, the temperature being the same; and this agency is mechanical pressure, and therefore these two agencies—heat and pressure—may co-operate, or antagonize one another.

The greater the pressure under which distillation takes place, the greater degree of heat will be required to effect the vaporization; and conversely, the gaseous condition can be produced at a lower temperature, by lowering the pressure in the retorts.

If the volatile fluid and solid substances produced by distilling coal were placed in a pure state, or unmixed

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with other bodies in a retort, and heated properly, they would distil over and leave no residue in the retort; but if they were intimately mixed with some poor conductor of heat like clay, and then subjected in a retort to a quick action of the fire, some parts of the mass would become much more highly heated than others; the portion in contact with the retort, and the vapors from this part tend to be disengaged, but as these vapors would meet with great pressure from the superincumbent and comparatively cool part of the mixture, they would tend to be recondensed and some only would escape.

The temperature still rising, a change would at length occur from this cause, and in the chemical affinities of the molecules of the volatile bodies, and new combinations would take place, in which a portion of the carbon —as that constituent which has the greatest tendency to be fixed—would separate and remain chemically uncombined, thoroughly disseminated intimately in a mechanical way among the particles of clay. Now, if the pressure in the retort and the heat should be sufficient, exactly what takes place in the interior of the mass would take place at the sides of the retort, where the vapors in a greater or less condition of rarity come in contact with the heated surface. The chemical affinities would be changed under the influence of the heat. New combinations would occur, in which, by the law of definite proportions, fewer atoms of carbon would be required; and the superabundant atoms of carbon would then be deposited in a state of great purity and close aggregation.

The volatile compounds of hydrogen and carbon in coal are the only portion yielding gas capable of giving light when burnt. Now it is well known that when the coal or any similar organic matter is distilled under a low heat, that the carbon has a disposition to pass off with little hydrogen. This gas will be rich in carbon, but as the temperature rises the liquid carbide of hydrogen diminishes in quantity and the gaseous carbide of

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hydrogen increases. And as the heat goes on to increase, the hydrogen continues to increase, and the carbon to diminish; or, the gas becomes richer in hydrogen and poorer in carbon. It is evident, therefore, that the deposit of carbon is caused by the combined agency of heat and mechanical pressure, the latter being the most powerful of the two.

It is well known to many persons here, that in 1867 I contrived a means to prevent to as great an extent as possible the deposit of carbon in retorts. This is known as "McIlhenny's Vacuum Process." Previous to this, I, like many others that were trying to make the retorts and coal yield good results, had a great deal of trouble from the accumulation of carbon. And knowing that successful experiments had been made by reducing the depth of the seal on the dip-pipes, I came to the conclusion that if the retorts could be worked without the *seal*, but very little carbon would be deposited. The theory on this subject to me is a very simple one, because it is manifest that if the gas can be removed whilst it remains in a state of vaporization, the carbon cannot be separated from the hydrogen. And it is a well-known law of organic chemistry, that the higher the temperature and the more advanced the decomposition of the substances, the simpler are the products. The affinity between the carbon and hydrogen seems to diminish. It would then be the natural tendency of the carbon to adhere to the heated surface of the retorts; but if the whole mass is removed before any separation takes place, very little will stick. In order, therefore, to remove all obstructions from a free flow of this mass of vapors, it is necessary to have the mouths of the dip-pipes perfectly free from obstruction.

Clegg says in his fourth edition, page 38, "that it is evident that the value of the gaseous and liquid hydrocarbons as light-yielding materials, is in direct proportion to the quantity of carbon contained in a given volume. The densest of the gases or vapors are therefore

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those which possess the highest illuminating power." All of the members of this class, however, as just mentioned, are more or less rapidly decomposed at a red heat, and in the usual process of gas making, the inner walls of the retorts soon become covered with a layer of carbon derived from this source.

This destruction of luminiferous constituents is dependent, on the one hand, on the length of time during which they are exposed to a high temperature, and on the other, upon the number of the particles of such constituents which come in contact with the red-hot sides of the retorts.

Two methods therefore suggest themselves for the prevention of this decomposition. The first would consist of the rapid removal of the gases from the retort, and the second in the dilution of the luminous by an admixture of non-luminous constituents, for it is evident that the number of atoms of illuminating gas, in contact with a given surface, would only be half as great if that gas were diluted with an equal volume of hydrogen, as it would be without such mixture.

In speaking further on this theory, I am satisfied, and it must be apparent to any one having examined the subject, that the actual and immediate cause for the deposit of carbon in retorts, is mechanical pressure; and when that is entirely removed, but very little if any carbon will adhere. When distillation first takes place on the inside of the retort, the vapors are in a heavy black mass, containing all the volatile portion of the coal. And this vapor is at a low degree of temperature, and only separates as the mass becomes more highly heated. And in this condition the atoms of carbon become condensed, and many of them adhere to the heated walls of the retort, and of course become separated from the mass of vapors. Now, it must be evident that if this entire mass were at once and immediately removed, and passed in the ordinary way to the holder, those atoms of carbon would be carried by the

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volume of hydrogen and become an illuminating agent, instead of sticking to the inside of the retorts; and when it is considered that the value of the gas for giving light is in exact proportion to the amount of carbon it contains, this matter will be appreciated.

When clay retorts were first introduced, the great difficulty in their use appeared to be the amount of carbon that accumulated, because of the greater heat under which they were worked. Owing to this fact, Mr. Grafton, at the Cambridge (England) works, commenced a series of experiments to ascertain the cause of the vast accumulation of carbon, and without going into all the details of his experiments I will simply give the results: From 67 tons of coal, 10 cwt. 24 lbs. of carbon was taken out, or $1\frac{2}{10}$ per cent. of the weight of the coal carbonized. This was under a pressure; but when he reduced that pressure he found the amount of carbon was very much decreased.

Mr. Smedberg has written me on this subject, and I do not consider his any mean authority. I think, therefore, that it is unnecessary for me to go any further to prove this theory, as I am sure that every intelligent gas engineer will admit it. I will now give you what has been my own experience under the operations of the "Vacuum Process."

The growth of carbon inside of retorts forms an interesting study, and doubtless there are those present who have watched its formation with interest. Although the atoms are not visible to the eye, yet the formation can be seen to increase from week to week; and if allowed to go on without being removed, it will entirely choke up the retort. The formation is continuous, but the quantity in the retorts is entirely dependent on the frequency of its removal. I have seen it on all sides and top of the retort, and hanging from the roof like rocks from a cliff. It was my custom before the use of my process, to clean out the retorts about every five weeks, but then the retort was very much impaired;

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two weeks before, and often several days after, leaky, so that I calculated that about three weeks embraced the entire time when the retort had its full capacity.

Now, in working the retorts with the "Vacuum Process," I make it a rule to clean them out every three months, but then there is less carbon than there would be under a pressure in three weeks. No carbon whatever collects on the roof of the retort, nor on the sides, nor in fact any part of it where the coal does not lie.

The exposed part is just as clean as the day the retort was fired up. It collects in the corners, and increases in thickness towards the back; this is owing to the fact that the vapors cannot get away as rapidly as where the coal does not lie, consequently become decomposed. The carbon adheres to the retort, but in my opinion if there was no obstruction such as the coal is, no carbon of any account would remain. If there was no advantage derived from the use of this method of working retorts, other than the prevention of the formation of carbon, it is of great value, in a monetary sense, as well as facilitating the operations of the retort house.

What would be the feeling of relief to every manager of a gas works, if he knew he could go on and charge his retorts from the time he set them until they were burned out. It having been fully demonstrated that retorts can be run from three to six months without cleaning, thus putting within the reach of every superintendent of a gas works, the facility of having to clean out retorts from two to three times a year only, instead of ten times, as is mostly the case now.

I do not deny that the general management of a gas works may not have something to do with this subject. In fact, I think that many companies make a grave mistake when they suppose that any man who can throw coal into, and draw coke out of retorts, understands the manipulations of the materials in the manufacture of illuminating gas.

Indeed, under this delusion a great many companies

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are suffering heavy loss; and some large companies, hundreds of thousands of dollars per annum. In addition to the prevention of the formation of carbon, there is a very important advantage in the increased yield from the coal. This of course will be increased just in proportion to the yield under the *pressure* system.

We will take for example Penn coal, and admit that the company gets $4\frac{4}{10}$ cubic feet per pound of coal: now if that yield can be increased to $4\frac{8}{10}$ cubic feet, and the company carbonizes 50,000 tons of coal per annum, the difference will be 44,800,000 cubic feet; or if the company uses 25,000 tons of coal, then the increase will be 22,400,000 cubic feet. But now, suppose the yield to be only 4 cubic feet per pound, then the difference to the company using the 50,000 tons of coal would be 89,600,000 and the company using 25,000 tons, 49,800,000 cubic feet. And so this scale goes up or down just in proportion to the amount of coal carbonized; assuming all the time that the gas be the same, or as good in quality. You will perceive, therefore, that these figures are indeed startling, but nevertheless true.

I suppose there are some present who have often wondered why it is that there is such a vast difference in the results of gas companies using the same materials, but such is the fact, there is a great difference. Now, there ought not to be much difference, because the same facilties are at the command of all.

It is true, however, that the same appreciation of the necessity of making high efforts to be at the top, and taking advantage of all the circumstances that contribute thereto, are not always realized alike. Nor is it to be supposed that all have equal abilities any more than in other professions; but notwithstanding these facts, there should not exist the differences that now do, in the results of the various companies.

You will perceive that the saving does not end with the decrease in the quantity of carbon deposited inside the retorts, nor the increase of yield from the coal, but ex-

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tends to all the incidental expenses of the retort house; and this saving is in exact proportion to the increased yield from the coal and retorts.

It will doubtless be asked if there is not some difficulty in working successfully under this process; and in response I will say, that all that is necessary is to thoroughly understand the principle and the means of carrying it out—and there can be no doubt of success. But I will admit that it is necessary to fully comprehend these points; but then it is to be presumed that every, or nearly every gas engineer fully understands these principles, and the mode of carrying them out. All the difficulties that encounter one in the use of this method are mechanical, and therefore easily overcome if properly understood.

I am often asked if the exhauster has not to be carefully run. Yes, if the means of controlling its actions are not perfect, or nearly so. Now, with me there is no difficulty in this respect, because I have a governor that has perfect control over the engine, and when this is obtained (which is easily done), there is no more difficulty or risk than there is in the old system.

If coal continues to be the material from which gas is made, I am satisfied that it will not be many years before this system is in general use.

On motion of Mr. White, the convention tendered a vote of thanks to Mr. McIlhenny for his address.

Mr. Sibley offered the following resolution:

Resolved, That the report of the special committee on insurance be referred to the following gentlemen: Messrs. Williams, Leavenworth and Steele, to obtain charter, forms of policy of insurance, etc., and to do all other things necessary to carry into effect the proposed system of insurance, on a mutual plan.

Mr. Steele—Mr. President: I decline to serve on that committee.

The name of Mr. Clegg was inserted in the resolution, in place of that of Mr. Steele.

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Gen. Hickenlooper—Do I understand that this action is taken by the Society to establish an insurance company?

Mr. Williams—This matter is to be taken charge of by this committee, and is entirely outside of the Association. That report is based upon returns from seventy-five companies or more, that desire a certain amount of insurance. The Association is not in any way responsible for any of the debts to be incurred, or for any losses, or anything of the kind. It is a system of insurance on the mutual plan. The parties who engage in it are responsible among themselves for all the losses that may be incurred, and are entitled to the benefit of the profits that may be realized. The Association has nothing at all to do with it, only as members of the Association present may express their opinions in favor of it or not.

Mr. Sibley—Mr. President: I will state that my object in offering that resolution is to test the sense of this Convention on this important matter of insurance. I suppose there is no gentleman in charge of gas works who does not know that it is a very difficult thing to obtain insurance from regularly organized insurance companies upon gas works, and it is likewise very annoying to those charged with the responsibility of their management, to be unable to obtain insurance at popular rates. This is the first time I ever heard the mutual plan suggested. I introduce that resolution simply with a view of drawing out the members of this Convention, who know more about it than I do. For my part I am very favorably impressed with the report of the committee, and I must say I feel disposed to vote for the resolution introduced. At the same time I have not fully made up my mind on it; but I should be very glad indeed to have the subject ventilated in such a way that would enable me to form, and likewise other gentlemen to form their opinions intelligently upon the subject. I regard this as one of the most important matters that could come before

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this Convention, and one that should be settled understandingly and carefully. The only reason I had in offering the resolution in its present shape is, that the subject might be before the Convention in some shape that would induce gentlemen to express their opinions freely.

Gen. Hickenlooper—From the manner in which that resolution is worded, if adopted, it commits the Association to the organization of an insurance company. If the object is merely to obtain an expression of gentlemen of the Association, merely as to the plan of insurance, I would suggest that that can be done by simply inserting the words, that we approve of the plan of insurance, and let that be discussed and voted on.

The President—I hope there will be no misapprehension on this point. Certainly nothing is more clear than that if this resolution is adopted, it makes this Association father this system. Mr. Williams has been at considerable trouble in getting up facts, and I understand he has a bill of $40 or $50 for expenses in doing so. Of course it would be preposterous—if you will allow me to use that word—to say this Association is not made the father of the whole thing. For one, I am very far from believing in the thing at all, and I hope before this resolution is adopted, a pretty full discussion will be allowed.

Gen. Hickenlooper—I move that it be amended in that way.

Mr. Sibley—I do not understand the amendment proposed.

Gen. Hickenlooper—The idea I had is this—that the resolution proposed to form an insurance company, by directing the appointment of a committee to procure a charter, etc. If it is desirous simply to obtain an expression of approval or disapproval as to the establishment of this company, that can be accomplished by asserting that this Association approves of the establishment of such a company.

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Mr. Sibley—I do not understand that this resolution commits the Convention to any particular method or mode of organizing this mutual company. It simply instructs this committee to prepare and submit a plan of organization at the next semi-annual meeting. It does not empower them to commit this Convention to any particular mode of proceedings.

Mr. Williams—I suggest that the resolution be amended by inserting the words, "that the Association should not be responsible for any of the expenses incurred."

Mr. Floyd—This Society ought to pay the expenses Mr. Williams has incurred in this matter. He was appointed at a meeting of this Society six months ago, to prepare this article, and whatever expenses he has incurred it seems to me this Society ought to pay. No gas company is compelled to go into this thing, and if this Society approves that document, no company need go into it unless it sees fit.

Gen. Hickenlooper—Does the resolution not commit the Society to pay for the procurement of this charter?

Mr. Floyd—I think the resolution only authorizes the committee to ascertain the mode of obtaining a charter.

Gen. Hickenlooper—If it was expressed in that way there would be no objection to it.

Mr. McIlhenny—I move that the whole subject under consideration be laid on the table.

The motion was lost.

Mr. Spencer—Mr. President: I am opposed to this Association going into the insurance business, just as I would be opposed to its going into the gas-meter or gas-pipe manufacturing business, or coal business, or any other business; for the reason that if we want insurance let us go into the market and buy it, and not complicate matters so much. If it is a mutual institution to be organized outside of the Association, let gentlemen desiring to organize that institution go and organize it without its having any connection with this Association. If

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this Association has authorized the gentleman here to procure information and he has incurred expense, as a matter of course this Association is bound to pay all the expense incurred up to this time; but I am opposed to incurring any further expense, and besides that, I am opposed to this Association committing itself, or taking any action in regard to that matter whatever. The subject has been brought to the attention of gas companies; they know what it is: and if there are those who desire to take hold of it in their individual capacity and organize an insurance company, let them do so; but if this institution is not to father it—not become responsible for it, why have it here at all? What has it to do with this Association in any shape or form? I am certainly opposed to this Association taking any further steps in that direction, but I am in favor of paying the expense already incurred in this matter. (Applause.)

Mr. Williams—As there seems to be some objection made to the trifling amount of the expenses incurred in this matter, I will withdraw the statement of the amount. I should rather pay it out of my own pocket than to have the matter questioned.

Mr. Spencer—I do not understand that any gentleman has said one word against paying for this thing, and I certainly did not say so.

The President—I hope Mr. Williams will not put me in a wrong light in regard to this matter. I said nothing and intimated nothing against paying the expenses that have already been incurred. It is perfectly proper that we should pay those expenses. I wish to make it clear to this Convention that if we adopt this resolution, we do father this whole thing. We have to pay the expenses in the first place of the preliminary examination and then appoint a committee to carry out the scheme. Mr. Williams must not attempt, with my consent, to throw back upon us the idea that we intend to be stingy with him. We pay all our expenses, and do not wish to be placed in a false position.

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Mr. Sibley—I introduced that resolution not with a view that the Chair suggests. I simply desired to know how far this Convention propose to carry this thing. They originated it before I became a member of the Association. That report of the committee struck me favorably, and I do not conceive that it is the intention of that resolution to commit this Association, or, to use the expression of the chairman, to "father this whole thing." It is merely with a view to have this scheme go on and be perfected, and be presented as a whole to this Convention, to be acted upon; not that it is to commit the Convention at all, but simply to perfect the whole thing, and then produce it as a whole at the next meeting of the Association. That is the object of the resolution.

Mr. Floyd—I move that the report be printed and sent to the different gas companies, and be taken up at the next meeting. At that time the matter will be perhaps better understood than it is at present.

The President—The motion is not in order. Something must be done with this resolution.

Mr. DeMill—It will be recollected that this Association was formed by gentlemen believing that something could be done to the benefit of the gas interest at least, and especially as it related to the manufacture of gas—the best material and best mode, and all these other things come up in connection with it, that might likewise be beneficial. Among them was a resolution passed at the first meeting in New York in April, a year ago, in the following words:

"*Resolved*, That the President be requested to appoint a committee of three members, to consider the subject of insurance, and report a plan by which the insurance interest of gas companies may be better protected."

Protected how? You apply to insurance companies in any of your cities to insure your building, or purifying box, or anything else, and they will charge you three or four per cent. The gentleman has corresponded with seventy-six companies throughout the country, and com-

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panies from all parts of the country have approved of this thing; and it is so clear in that report, that it seems to me we cannot go by it. You can elect if you wish to get insured in any other company. It does not oblige you to insure in this organization at all; but we believe it will be for your best interest to insure in this company, and if you go as high as two per cent. you will have a surplus in one year to pay any damages you may sustain. I understand that the gentlemen getting up this plan do not ask the Association to pay a dollar from this day. They merely want your approval, if you think well of it.

Mr. Steele—I find among these papers a bill of $40 for these expenses, and the vouchers for it.

Mr. DeMill—That grows out of that very resolution directing the committee to procure this very information, and they have done so.

Mr. Severance—There are two questions involved here. One is as to the organization of that company; and the other is whether gentlemen approve of that insurance. If the matter was submitted separately, it might be easily determined. Now it is said here that there are seventy-five companies who desire to enter into this insurance. It seems to me if these seventy-five companies want to form this company, they ought to do it. We should say, Go ahead and form this company. We do not want to do it. There is that difference in the question. We are not obliged to do it; and all that is needed to be done with the resolution is to divide it, so it shall take that position.

Mr. McIlhenny—Mr. President: This Association has no legal status. Its indorsement can give it no legal force. Who would take stock in an insurance company, indorsed by this Association? The company must have a charter from some authorized body. All the force this Association can give to it is a moral force. If any gentlemen wish to get up an insurance company, let them apply to the Legislature, or to Congress,

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and then let the gas companies insure in it. There is no necessity for this Association indorsing it, because over one-half of them would not insure in it. If any gentlemen wish to take stock in the company formed by these gentlemen, let them; but this Association cannot give them a charter, nor would their indorsement be worth two cents.

Mr. Sibley—The resolution requests them to procure a charter.

Mr. McIlhenny—Why is it necessary that the Association should request them to procure a charter? Can they not procure it without?

Mr. Williams—There are seventy-five companies there.

Mr. McIlhenny—Very well, let those seventy-five companies write out a petition for a charter. This Association has nothing to do with it; this Association started with the object of seeking information in reference to the manufacture of gas. The question of insurance, as one gentleman remarked, is very much like the manufacture of pipe, or mining coal, or any other subject that enters into the pursuit of gas-making—a subject that this Association has nothing at all to do with. I renew my motion that the subject be laid on the table.

Mr. Wood—There seems to be some mistake about these seventy-five companies, who have all indorsed this insurance company. Now, we received from Mr. Williams a circular, containing certain questions, which I, myself, replied to. I did not in that reply indorse this scheme, and do not now indorse it before this Association. I do not think that this Association is in any shape whatever to go into the insurance business. Let these parties organize a company, and such gas companies insure with them as they can get. The resolution read by the Secretary was proposed by Mr. Williams, and with all due deference to his interest in this matter, and his very able report upon this subject, I hope this motion to lay on the table will prevail, and the motion rest where it ought to.

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Mr. Sibley—I submit that the motion is not in order. It has been disposed of once, and there has been no intervening motion.

Mr. Spencer—I move that the subject be indefinitely postponed.

Mr. Floyd—Before that motion is put, I think it would be better to have it understood that the Society means to pay to Mr. Williams the expense he has incurred.

Gen. Hickenlooper—That is a matter that has no connection with this subject at all.

The President called Mr. DeMill to the chair, and spoke as follows:

I happened to be on the first committee to consider the insurance question. This matter was brought up at the very first meeting, at which the Association was organized in New York, a year ago last April I think it was. I was placed upon that committee; the committee had a meeting at the St. Nicholas, talked the matter over; and, finally, I intentionally wrote a vague report to the Convention, which I read. It covered about one page of letter paper, in which I suggested that it was worthy of consideration, whether gas companies might not organize an insurance company for the insurance of holders, and other kinds of apparatus, and left the whole thing to future examination and discussion. I found that some of our leading friends East were entirely opposed to the whole scheme, and said it would never do; the more I thought of it, the more I thought it would be utterly impossible to make a thing of that kind practicable, under the name of this Association. When we met in October, Mr. Williams was anxious to have a report made on it, and he will bear me out in saying—a report made in favor of it. I said we did not have the information, and were not prepared to indorse any such scheme; that what we wanted in the first place, was to get information, and then let the Society consider and decide upon it, if it should choose. Finally, the

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committee broke up—could not agree upon any report, and the result was Mr. Williams alone was appointed to investigate and report. Mr. Williams has gone on, sent out circulars, gathered up information, and has incurred some expense in doing it. He has been acting entirely under the instructions of the Association, and we are all glad to pay that expense. There has been no intimation to the contrary; but there is quite a number of us who are entirely unwilling that this Association should go into the business of insurance, or authorize, or give its approbation to any particular scheme of insurance. This is a much weightier question than gentlemen may think. It involves getting a charter for the whole of the United States, and commits the Association to the organization of a grand insurance company, for the insurance of the gas property of the country. We bring ourselves directly in opposition to, and separate ourselves entirely from the insurance interest of the country, and set up an insurance company. It strikes me that we are running against a very fatal rock in doing this thing. The object of this Association is not to organize meter companies, coal companies, or any other kinds of business; but, as our Constitution says, for the purpose of diffusing intelligence on the best system of making and distributing illuminating gas. It is organized, as I said to the Association this morning, for mutual improvement in these things, and not to promote any particular scheme of insurance, or any other scheme for the making or saving of money, by setting up a business.

Now, I think, one gentleman who has spoken hit the matter precisely on the head, when he said, Let all gentlemen who are in favor of the sentiments of this report, as many of them as please, outside of this Association, organize their insurance company, obtain their charter and go ahead, and ask companies to come in and insure if they like. Nobody can have any objection to that. I have no objection to that; but I do feel a very

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strong objection to committing this Association, in any sense, to the approbation of this scheme, or any other special scheme of insurance. We have gathered the information, and we propose to pay the expenses incurred in doing it. Let companies do as they please, and gentlemen who are interested in getting up an insurance company, go ahead individually and do so, but let it be clearly outside of the Association. (Applause).

Mr. Steele—I would say that the vouchers of this expenditure have been handed to me for examination. A bill of $40 has been paid by Mr. Williams; hadn't we better approve the bill?

Mr. Spencer—I think it is entirely separate from this. I will immediately after the disposition of this question, not only consent that the bill be paid, but that the gentleman be paid for his trouble.

The President—I do not think the action of the Convention upon the motion disposes of the question of the payment of that bill.

The motion to postpone was put and carried.

Mr. Steele—Mr. President: Is it proper for me to introduce the subject of this bill now?

The President—It is.

Mr. Steele—The bill is $40, the vouchers are all here, and I move that the bill be allowed and paid. Carried.

Mr. Walker—Mr. President: If it is now in order, I move that papers be discussed as they are read.

Mr. White—Mr. President: As there are several papers yet to be read, I move that we proceed to the reading of those.

Mr. Walker—Mr. President: I move we proceed to discuss the subject of Mr. McIlhenny's paper. Carried.

Mr. Walker—I would like to ask Mr. McIlhenny a question, in reference to his arrangements, whether he uses an exhauster?

Mr. McIlhenny—I stated in the paper that I did.

Mr. Walker—Do you consider it necessary to use an exhauster to get such results as you speak of?

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Mr. McIlhenny—Certainly.

Mr. Walker—Do you think such results can be obtained by doing away with the exhauster?

Mr. McIlhenny—Well, it is possible, but entirely improbable, according to my idea.

Mr. Walker—My idea in asking the question is this: Suppose we had a pressure of five inches, your seal would at least require to be six inches to be safe. Now make it, say, five and a half inches, and by removing it a half inch you would still have five inches, and my question was—What great result would be got by doing away with the half inch?

Mr. McIlhenny—I stated in the last portion of that paper, that it was necessary for a person to thoroughly understand the principles involved in this matter, before he could comprehend it. That the exhauster stands between the hydraulic main and the purifiers, and there is no pressure on the retorts after it leaves the exhauster. Of course, between the exhauster and the holder it makes no difference what the pressure is. The exhauster draws from one side and forces on the other.

Mr. Price—How do you run your exhauster?

Mr. McIlhenny—We run it at zero.

Mr. Littlehales—I presume there is no gentleman present who has as much as six-inch seal on the dip-pipes. What would be the necessity of it? Because you would not send six inches to the governor; therefore you would not want to have a six-inch pressure on the gas-holder. You would not want six inches of seal on the dip-pipes.

Mr. Walker—I assume it is six inches.

Mr. Littlehales—I presume no one would have anything like a six-inch seal on the dip-pipes. I should think an inch would be ample, and, therefore, if that were the case, there need be but little deposition of carbon in the retorts. One reason why I find there is a great deal of deposition is, the manufacture of the re-

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torts themselves. A retort that is well glazed will not have anything like the same amount of carbon deposit. Then, again, in a retort that is kept well stopped, there will not be as much deposition in that retort as in one that has a great many holes in it. My experience is, therefore, that having the exhauster about level gauge, having about an inch seal on the dip-pipes, there will be very little trouble with carbon in the retorts, unless the heats are very high. I do not consider that high heats are more advantageous than exceedingly low heats, because if you have high heats you get a little larger production; but you get the purifiers fouled quicker. I would like to ask the gentleman who read the paper, What is the production of gas from coal in his works?

Mr. McIlhenny—I am very willing to state that, but I do not feel at liberty quite.

Mr. Littlehales—That would give us some idea as to the value of the process submitted to the Association.

Mr. McIlhenny—I would state, however, that it is beyond five feet, considerably.

Mr. Littlehales—From what kind of coal?

Mr. McIlhenny—Well, last year we used about 75 per cent. of coal from Western Virginia, about 20 per cent. from Pittsburg, and about 5 per cent. of Western Virginia cannel. The illuminating power averaged 15 7-10 candle power.

Mr. Littlehales—State how much coke you get per ton.

Mr. McIlhenny—We sold about seventeen bushels to the ton.

Mr. Littlehales— The production?

Mr. McIlhenny—The production entirely depends upon the kind of coal you use.

Mr. Littlehales—Take the coals you were speaking of.

Mr. McIlhenny—Western Virginia coal produces less coke, although of a better quality than that produced by Pittsburg coal—about thirty-six bushels to the ton—

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and the Pittsburg coal about forty-two bushels to the ton.

Mr. Littlehales—I wish we could get Western Virginia coal. So far as my experience has been, those results are scarcely attainable.*

Mr. McIlhenny—I would state this for the information of the gentleman, that the West Virginia coal will not produce as much as the coal from Pittsburg, and there would be no advantage in getting it.

Mr. Littlehales—Then, if that is so, it seems to me there is a loss some way or other, if it will produce five feet.

Mr. McIlhenny—It produces thirty-six bushels to 2,240 lbs. There is a cannel coal from West Virginia—a very fair cannel—that produces about 10,000 feet to the ton.

Mr. Walker—I have understood from parties who use this, or a similar process, that if they remove the seal from the dip-pipes, the yield is very largely increased, even without using any exhauster.

Mr. McIlhenny—That cannot be so.

Mr. Littlehales—Anybody who understands the principle, can see at once that this is a false idea, yet I understand they say so.

Mr. Walker—There is a good deal of misconception about that thing. I was looking over a few old works and I found the hydraulic main working at six inches. Something like twenty years ago my attention was directed to that, and I commenced then to remove the tar, by drawing it off from the bottom of the main, and have continued to do so ever since, and never had any difficulty with heavy tar when the liquid in the main was always kept at the same specific gravity.

Mr. Littlehales—Did I understand the gentleman to say that the tar became so thick that it is very difficult to get the gas through it?

*Mr. Littlehales means in the New Dominion. His works are at Hamilton, Canada.

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Mr. Walker—Yes, sir; I say that.

Mr. McIlhenny—I would say that this process I have been speaking of, does not subject the gas to the tar at all, and is not subject to that objection.

Mr. Walker—I did not make that objection in reference to the McIlhenny process. I state that this is a great trouble, and a great cause of carbon in the retorts, and I said that drawing the tar from the bottom of the main, would be a means of preventing it, and that the fluid through which the gas passed remained all the time of a uniform specific gravity. Now, I am just as anxious for improvement as everybody else; but when we can make a good quality of gas, 14 or 15 candles, using Pittsburg coal, I think it is doing very well for the old process, and I cannot see the advantage of this thing.

Mr. Littlehales—(to McIlhenny)—Do you seal each retort, or each bench?

Mr. McIlhenny—Each bench.

Mr. Littlehales—That seems to be open to great objection. I believe it is very unwise for the gas manufacturer, to charge the whole of his retorts at the same charge, because if you put 1,500 or 1,600 weight of coal in each bench, you must necessarily check the heat. If you take two or three of them, then charge two or three afterwards to equalize the heats, you will get better results. It seems to me that the process which the gentleman submitted, is liable to the objection that you must charge all from the bench at the same time.

Mr. McIlhenny—I did not state anything about the method of doing this thing. I supposed at this time everybody understood what those details were. I will state to my friend over there, that each bench divided by divisions of the hydraulic main, was the old way of doing it many years ago. In using this process I speak of, it is not necessary to charge the retorts all at once. If you wish to do so you can do it just as well, because the seal is put on when the retorts are being charged,

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and removed when the retorts are charged. You seal the bench, then charge it, and after the charge has been put in, you remove the seal. The paper I read here to establish the principle of this method, stated nothing about any particular way of doing it. I was particular about that, because I happened to be, perhaps, the first one in this country to try this thing; and since then, if I may use the expression, there has been a perfect diarrhœa of schemes. (Laughter.) I only submit the matter as an argument, to prove the principle involved. If any gentleman can controvert these facts, to disprove the principle involved in that paper, I would like to hear him. The simple method of removing the seal and putting it on, is a mechanical operation. It does not require any particular education to comprehend it. The principles involved, however, are a little deeper, and unless a person understands them, and knows their use, it would be folly for him to undertake it; but putting the seal on and taking it off, and putting the pipe in the hydraulic main, is very simple, and any mechanic can learn it in half an hour. I can explain that to any gentleman in five minutes. Mr. Walker states it can be done and the same results can be obtained without removing the seal. Now, I would like him to show upon what theory or upon what principle, those results can be obtained with the seal on. I distinctly stated, and I will state again, that carbon is produced, or rather, it sticks to the retorts, because of mechanical pressure. If any one can controvert that argument, I would like to hear him. The mechanical part of this contrivance is so simple, I did not think it necessary to explain it, consequently I left that part of the detail out.

Mr. White—Mr. President: Since this discussion has commenced, I have been reviewing the experiences of the past five or six years of my life, in connection with these questions of the advantage or disadvantage of dispensing with the dip-seal. Like Mr. Walker, I tried to make all the yield possible from the coal used, and with

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him found that my first obstacle lay in the density of the liquor in the hydraulic main. I used means to make this liquor more limpid, and gained an increased yield. My next step was a reduction in the dip-seal in the hydraulic main, from one and a half inches to one inch, and further to half an inch: these latter changes gave me most gratifying results, both as to yield and quality. During these trials, I had gradually increased my heats to what we now designate "very high heats," heats as nearly white as possible; also, in running my exhauster, I made it a point to secure a vacuum, not merely on a gauge in my exhaust room, but an absolute vacuum at the mouth-piece of the retort—thus I secured many of the good results Mr. McIlhenny so justly claims from the application of his theory, and found my company selling a yield per ton of 10,800 cubic feet of gas of a good illuminating power. What I had done, convinced me of the value and need of some process whereby the dip might be removed, and the full advantages secured, as my results were, practically, but a cruder way of getting at the same thing, for, as I worked, my exhauster actually drew the liquor in the hydraulic main down below the ends of the dip-pipes, so unsealing them to all intents, but not so fully as can otherwise be obtained. In further corroboration of the principle involved in Mr. McIlhenny's paper, it was my good fortune, in assuming charge of the works of the People's Gas Company of Brooklyn, to find a number of what is known as the Gibson Valves—another contrivance for dispensing with the dip-seal—placed upon the hydraulic mains. I am thus enabled to give the results of some practical experiments made upon this theory. In some of these experiments I had the assistance of other and more skillful engineers, and the results obtained gave an increase of from one-third to one-half cubic feet per pound of coal—from one to one and one-half a candle gain in illuminating power—while the accumulation of carbon in the retorts was very much less than under the old method of working.

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It is but just to say, that these experiments were carefully conducted in every respect, and that the results have been constantly reproduced, and are matters of record with that company, as they still use the Gibson Valve, I am informed, with satisfactory results.

In reply to Mr. Walker's remark, that some works are producing with seal as good results as are made without seal, it can only be necessary to say that works in every way similar as to apparatus, show even greater variation in their productions, and so long as men differ, and intellects vary in culture, just so long will special men produce greater results than the general man. Meaning no disrespect to the capable gentlemen who have preceded me, in the charge of some works I have conducted, I have taken the same apparatus and secured many of the results claimed as being had alone from the use of appliances for dispensing with the seal; and yet, subsequent experiment confirms my belief, that I might have done better by using some such appliance. I will close in saying that the result of my experience is, that a reduction of seal, all else remaining the same, will increase the quantity and quality of the gas produced, and that a still greater gain is obtained by dispensing entirely with the seal; so far, facts justify me; beyond this arises the question as to the proper means to apply, and this being, in most of its aspects, a purely mechanical question, must find, as all such queries do, diverse solutions.

The President—I am very glad indeed that Mr. McIlhenny has relieved himself of any suspicion of advocating any particular system of removing back pressure. Some members of the Association might have gotten the impression that he was advocating McIlhenny's system. I think we ought to be careful about advocating any special system. We do not wish to aid parties in selling patents, but we wish to learn the true principles upon which to run our works.

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A paper on Naphthaline was then read by the Secretary, Mr. DeMill.

On Naphthaline.

By J. Herzog, Esq., Chief Engineer of the Metropolitan Gas-Light Company, New York City.

Gentlemen: Having been appointed at your last Convention, to prepare a paper on matters and questions appertaining to Naphthaline, one of the residual products of the manufacture of gas, I respectfully submit the following:

Naphthaline, the existence of which, according to the latest edition of the "Book of Inventions," was first proven by Garden, in 1820, comes over late in the distillation of coal tar. It is a solid at ordinary temperatures, and when pure forms large colorless crystalline plates; it has a faint, peculiar odor, is unctious to the touch, and evaporates slowly at the common temperature of the air.

Naphthaline is not absorbed by water, but it is by the volatile and fixed oils, and by naphtha and coal tar; hence the advantage of keeping the raw gas, until it is thoroughly cooled, in contact with tar and ammoniacal liquor, in a long hydraulic main.

Richer qualities of gas containing much hydrocarbon, do not deposit naphthaline, and hence the use of naphtha as a remedy for naphthaline in the mains and service pipes. Naphthaline is not easily decomposed by heat; it is quickly deposited by cold, forming brilliant white scales, which have a tendency to collect in the bends of pipes, and wherever there is an impediment to the easy flow of the gas.

For the gas engineer, it seems most important to prevent the crystallization of naphthaline, and this it appears to me can be done by keeping the gas containing naphthaline in contact with the light volatile oils; though all the chemical properties of naphtha-

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line are not yet discovered, it is a well-known fact that naphthaline shows a great affinity for light hydrocarbons. In gas generated at a low temperature, many of the volatile substances are lost in an undistilled condition, with the tar in the hydraulic main and connecting pipes, in their liquid form, and combine with, or rather, take up, the naphthaline. Under an increased heat, the greater part of these oils would form fixed gas, and consequently increase the volume of the gas manufactured. Though it is a great advantage to make use of as great a quantity of these lighter oils as possible in distilling the same to gas, we all know that all the lighter oils cannot be used up entirely in the distillation of coal, and thus it seems the duty of an enlightened gas engineer not to waste the same, but to make a judicious use of the same in keeping the gas as long as possible in contact with the gaseous vapors, and thus preventing the crystallization of the naphthaline which is contained in the gas. The lighter oils, as long as they are united, will, whenever they settle down in a condensed state, carry away a great deal of naphthaline in a liquid form, and the naphthaline will, in a pipe placed in proper descent, be carried on to the drips. The lighter oil vapors will separate from the gas at low temperature; in condensing, therefore, I fully agree with many, that the take-off pipes from the hydraulic main should be nearly on a level with the same, and should be of sufficient length. Clegg gives us as a rule, that for every inch of diameter, the take-off pipe should have a length of ten feet, the working pressure being two inches; for instance, the take-off pipe being ten inches in diameter, the proper length would be one hundred feet. By increased working pressure they will, of course, require increased length, in ratio of their square roots; but, even at this rate, a great deal of the lighter oils will be lost in condensation.

I have found in my own experience that those oils,

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if collected in a little tank, and re-vaporized, will greatly diminish the tendency of the naphthaline to crystallize, and at the same time improve the quality of the gas. The form of such an apparatus would be a small iron tank, closed at top, and placed below the level of the inlet-pipe of the condenser, to which all drip water, and with it the ligther oils, must be conducted; the lighter oils will, from the nature of their specific gravity, float on the top of the tank. By passing a coil of steam pipes through the tank, the lighter oils will be vaporized, and the naphthaline will settle at the bottom, and from there can, from time to time, be let off. If from an insufficient amount of these lighter oils, some benzine, benzole, or naphtha can be added with advantage, particularly if coal be used containing only a small proportion of these lighter oils. Hydrocarbon vapors will surely liquify naphthaline in any pipe or vessel.

A further tendency of naphthaline to crystallize will be created if gas containing naphthaline is passed in from a hot to a cold place: say for instance, if the gas be stored in the holder and the same without a building is exposed to a heat of high temperature; when let into pipes in the ground which are located in a lower temperature, naphthaline will surely crystallize, and in course of time will stop up the pipes more or less; or, if the street mains are in certain locations laid too near the surface of the ground, and afterward the gas be passed into pipes located in lower ground, by which a variation of temperature is created, naphthaline will have a tendency to crystallize.

Mr. Hyde, of Cleveland, also read a paper on the same subject.

Naphthaline.

By G. A. Hyde, of Cleveland, Ohio.

In the manipulation of the gas, in the process of manufacture of illuminating gas, one of the annoyances to which the manager is subjected, is the deposit of crys-

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tallized naphthaline, and any experience had in regard to the course of its deposit, method of prevention or removal, is sought by most managers.

That the amount of this crystallization is variable is probably evident to most managers; but a diversity of opinion exists as to the real cause of its profuse development or else to the best method of preventing its crystallization and deposit.

Naphthaline is a white crystallizable substance evolved by the distillation of bituminous coal. When crystallized it is a very delicate film, yielding to the gentlest touch, yet, under favorable circumstances, it compacts, and is capable of considerable resistance. It has a peculiar faintly aromatic odor, not unlike narcissus; is heavier than water, and is readily dissolved by naphtha.

During the fifteen years of my experience as engineer of the Cleveland Gas-Light and Coke Company, in the manipulation of the gas, varied results have been observed. In the process of condensing and washing the gas, our usual method has been to condense first and then to wash. At one time it was thought advisable to erect a spray washer between the hydraulic main and the condensers, as is the method in many gas works. Soon after there was observed a rapid accumulation of naphthaline in the drain leading to the tar-well, in the purifiers and pipes about the works, and also in the distributing mains in the streets. At a subsequent period these spray washes were removed and placed between the condensers and purifiers, used in connection with the purifiers, and very much less naphthaline was crystallized. During the periods mentioned, the heats of the benches were what is termed "high."

During the past cold season, there was used with the common bituminous coal, from 4 to 8 per cent. of cannel coal; the heats were not high; the gas was kept hot while passing from the retort-house to the condensers—about 150 feet—by encasing the pipe; the condensation was very gradual, by the use of open-air condenser,

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and but a small amount of water used in the scrubber and no spray washer. During this period we had no crystallized naphthaline.

It has always been observed that wherever high heats were carried, more naphthaline was crystallized than with medium heats, and that when a bench was lightly charged, after being cleaned of carbon, and while hotter than usual, naphthaline appeared more abundantly than under ordinary circumstances.

My deductions from the experience at our works are as follows:

The crystallizing of naphthaline is caused first by "high heats," and the amount increased by rapid cooling of the gas by contact with cold water, cold pipes, and rapid cooling otherwise: and that naphthaline is more likely to be developed in gas made from slack coal than from lump coal. The remedy I would suggest for this annoyance is the use of a small percentage of cannel coal, in connection with the common bituminous coals, moderate heats, long exposure of the gas to hot pipes or other condensing operations, before reaching the cooling condenser; slow cooling of the gas and scrubbing with a small amount of fresh or ammoniacal water of moderate temperature; and, also, when found necessary, the introduction of a small continuous supply of naphtha into any horizontal pipes about the works, after condensation, or into the drips of the inlet and outlet pipes to the gas holders. The evaporation of the naphtha will dissolve the naphthaline crystals.

My deductions may not all be strictly correct, but my observations lead to these results.

Mr. Walker—I would like to ask Mr. Hyde as to the result.

Mr. Hyde—I can hardly answer that intelligibly. We have got big results this last winter, for the reason that we were running without seal.

Mr. Walker—What yield did you get?

Mr. Hyde—The yield has been very much greater

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since removing the half inch and heats just as high; I cannot give from memory the exact figures.

Mr. White—Upon the subject of naphthaline, if I may presume to again address the Association, I had some troublesome experiences before learning its nature. High heats have been so constantly upbraided as the parent of this *enfant terrible*, and so thoughtlessly and unjustly, that I must try to rescue them from blame. I admit that high heats undoubtedly place us in position to be annoyed with this crystal, but so did the use of steam put us in jeopardy from railway accidents. Of late years we have been putting our brain work into our retort houses faster than in our other apparatus, and the result is the unfortunate under dissection. High heats, low seals, rapid evolution of the gases, their hasty removal from the retort, and their sudden plunging at a high temperature into the showers of spray washers, or through yards of chilling condensers, soon gave birth to the lusty and troublesome crystal nuisance that sheds its favors, like some divine blessing, upon the just and unjust, causing gas managers to drop into profanity.

The agency of heats in producing naphthaline lies simply in converting into a gas, at a high heat, olefiant qualities, that at low heats pass over as oils. In order to retain this (at that point) easily condensed, volatile oil in a gaseous form—three methods are open to us: We may mix free hydrogen with our coal gas at a high temperature; we may introduce into our coal gas, gas made from naphtha; or adopt the plan of having a long connecting main, protected from the atmospheric changes, between the hydraulic main and condensing apparatus, so retaining the crude gas as long as possible in contact with its own condensable vapors, and subjecting it to a gradual lowering of temperature. I have made a practice of introducing the water into my condensers at the "outlet" end and taking the overflow from the "inlet" end, so causing the gas to come first in contact with pipes somewhat higher tempered than I could

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otherwise do, and so continuing my scheme of gradual cooling, I use but little water in actual contact with the gas, believing more in the efficacy of the dry scrubbing it gets in passing the divisions of the washer, than in water as a cooling agent in that stage. (I may say, parenthetically, that since my visit to Cleveland, I believe less than ever in the virtues of water.) Following these general views, I have succeeded in escaping any further trouble from naphthaline, save an occasional warning presence in my purifiers, when I accept the hint and look for something wrong back of them.

When gentlemen come to understand the chemical laws governing the deposit of naphthaline, the great step to its prevention will have been taken, and it will pass out of the category of nuisances and be blessed for its useful qualities.

Mr. McIlhenny—I would like to add a word to what has been said. I must say that I indorse, to a great extent, what Mr. Hyde says as to naphthaline. Now, I find that the promotion of crystallization of naphthaline is always at a point where the temperature is very much colder than the point from which it leaves the holder. The gas does not change its condition after it goes into the holder, and I do not think the theory which Captain White advances, that coming in contact with its own constituents, for any great length of time, will prevent its changing its condition by the condition of the atmosphere; for instance, you run a quantity of gas from a point—say 80°—when the sun is hot, in the spring of the year, and into the ground; say that it is then 30° where the gas strikes the service pipe, close upon where it enters the building, the volume in the service pipe not being so great the moment crystallization takes place. I think the condition of the gas is not changed by its contact with other constituents of carbon. We ought to acknowledge that high heats convert these light carbons into gas, instead of leaving them in their original condition.

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Now then, my theory is that when these light carbons are converted into gas, it is done by high heats; that if you can distribute it in an even temperature, you leave no naphthaline; but if you cannot, if the temperature of distribution varies, then I think you cannot prevent it.

Mr. White—I will say, Mr. President, that the gentleman is merely carrying out in these remarks just exactly what I say—that the pipes from the hydraulic main to the condenser must be kept at an even or gradually lowering temperature. Clegg says, that the length of such a main should be ten feet for every inch of diameter you have in the hydraulic main. I find such a rule to work well enough in practice, and recommend it.

Mr. Littlehales—I have had some little experience in naphthaline, and my experience is precisely the same as the gentleman whose paper was first read, and the gentleman in the corner (Mr. White), as to the cause of it; but there is one little discrepancy, as it appears to me, in the gentleman's statement. He says that high heats are the cause of naphthaline—he also says that he cannot get the heats too high to suit him, and yet he argues that we should try to prevent the formation of naphthaline. Two things it seems to me are diametrically in opposition to each other. If a high heat is the cause of naphthaline, then let us have lower heats.

Mr. White—I was combating that theory, sir.

Mr. Littlehales—I believe it was Dr. Letheby who called the attention of the British Association to the fact that tar had a great affinity for naphthaline, and if engineers would only keep the gas long enough in contact with the tar, it would remove the naphthaline from the gas.

I believe that has been tried and been found to be a perfect success in every case. We once had a great difficulty with naphthaline. The cause was this: We were working at exceedingly high heats, and the condensing power was very inefficient. The engineer of the company, Mr. Cathels, had put up not much less than

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three or four hundred feet of pipe round the retort-house, following that was a battery condenser, which differed from anything I have seen yet in this country. It was constructed of 14 rows, with plates each 4 feet wide, 3 feet deep and 18 feet high, with pipes across it, through which the air passed. The advantage of the battery condenser is that the gas comes in contact with the tarry surface, by being tumbled backwards and forwards amongst the pipes in its passage up and down. From the time we had the condenser started, we were never troubled with naphthaline. The removal of naphthaline can be entirely and completely effected by keeping it in contact with the tar.

Mr. Walker—I cannot understand this idea of keeping low heats to prevent naphthaline. Low heats will reduce our yield. Our business is to get all the gas, and of the best quality we can from the coal—study carefully the combinations formed during the distillation, and apply them to their proper use. Naphthaline being composed of hydrogen and oxygen, is a light-giving substance—not to destroy, but to preserve and utilize. I have never been troubled with any accumulation in my hydraulic main since. Some twenty years ago, I adopted the plan of drawing the tar from the bottom. I have found this a complete preventative, and when I want to empty it I just turn down the pipe and let it run perfectly clear.

Mr. Hyde—(to Mr. White)—Did I understand you to say that high heats are the cause of naphthaline?

Mr. White—I say that high heats are indirectly the cause; they rendering it possible for it to appear.

Mr. Littlehales—That is to say, although naphthaline is generated, he removes it in the way I suggest. The naphthaline is taken out by the tar.

Mr. Walker—That is my theory of it. Mr. White's idea of the naphthaline question is this: That with high heats we produce it, but with care and chemical knowledge, convert it into a permanent gas, increasing our

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yield, and at the same time preserving a high standard as to quality.

Mr. Nettleton—Mr. President: As I regard it, and as other gentlemen have expressed themselves, high heats are necessary in all cases to generate naphthaline. But my idea of naphthaline is that it is a vapor running along with the gas, and is not a gas itself; and that if you run it along with the other elements of the gas until the gas is properly and gradually cooled, there are certain elements which keep that vapor in contact with the gas; and carried forward with the gas into the holder and from the holder to the burner, it forms an element of light when the gas is consumed at the burner. I am no chemist, but that is what I understand to be the nature of it.

Mr. Walker—Mr. President: In corroboration of Mr. Nettleton's ideas, I will state that about a year ago I was remodeling an old work; I carried the collecting pipe from the hydraulic main the entire circuit of the retort-house; previous to this change they had been greatly annoyed by naphthaline, but since this change it has entirely disappeared, and as it does not appear to go to the tar well, my theory is the same as that which appeared about nine years ago, in the *American Gas-Light Journal*, over the signature of "Out West," that naphthaline in the form of vapor, by being kept in contact with the highly heated light hydrogen, produced at the latter end of the charge, is converted into a permanent gas.

The President—I do not suppose that it is necessary to say a word, but I suppose that all washing should be deferred until after condensation. Gas should never be washed until after it is condensed ("Hear, hear"), and that it should be condensed slowly, and just as little water should be used as possible.

Mr. White—I look upon the use of water in washing gas very much as the Irishman did upon its presence in his receipt for making punch. He said you first get

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the lemons and the sugar, and just a sup of water, then plenty of whiskey, then a little more whiskey, then, may be, a trifle of sugar, and then every drop of water you put in after that is ruination to the punch. (Laughter.)

The Secretary read a paper from Mr. Wm. H. Grenelle, on the

Vacuum Process.

William Gibson's Combined Valve and Dip-Pipe.

Letters patent of the U. S., No. 119, 135, September 19, 1872, subject to the generality of United States' Patent No. 95,459, "introducing one or more valves, or cut-offs, at any convenient point between the gas-producing materials in the retort and the liquid contents of the hydraulic main," and of No. 116,450. No. 4,800 and No. 5,771: "providing two outlets for the gas from the retorts, one by a dip-pipe and the other by a free passage, capable of being closed by a valve or cut-off:" and co-operating with and controlling No. 117,880 "sealing and unsealing the dip-pipe by a mechanical device introduced below the water line in the hydraulic main, combined with an automatic attachment preventing the removal of the lids of the retorts until the seal is restored;" also No. 125,043, "combining a number of stand-pipes under one valve;" also No. 144,619, "an improved hydraulic main, that seals and unseals dip-pipes, by raising and lowering the liquid contents of the hydraulic main, without the use of water."

Wm. H. Grenelle, Special Agent,
42 Pine Street, Room 18, New York City.

Gibson's Process, preventing the formation of hard carbon in the retorts, by relieving them from pressure, during the manufacture of illuminating gas, and controlling and regulating the production of gas from ordi-

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nary caking coals, at a fixed standard of illuminating power, has been applied, during the past six months, to the Cambridge Gas Works at Cambridgeport, Mass.; at Peoples Works, Brooklyn, N. Y., and at Peoples Works, Albany, N. Y., with satisfactory results.

The record at the new gas works at Cambridgeport, Mass., is, of course, more advantageous to the valves, than that of less modern gas apparatus, and therefore these works are not quoted, except as a reference, for preservation from carbon in the retorts, and for a general statement of yield per pound of coal used and cubic feet of gas per retort charged.

Gibson's Combined Valve and Dip-Pipe was first applied at the Peoples Works, Brooklyn, N. Y., on the 10th day of November, 1873; the works were altered from dip-pipe seal very gradually, and without any interference in the ordinary working of the retorts, save that a charge was missed during the hour taken to adjust the valve; the facility of application enabling the substitution to be made, without the employment of extra labor. On the 29th of November, 1873, four retorts in a bench of fives were fitted with valves, the other left in old dip-pipe seal of $1\frac{1}{4}$ inch; the retorts were new, 8 feet 6 inches by 12 inches by 20 inches, and charged continuously until Feb. 5, 1874, with from 1,000 lbs. to 1,050 lbs. of Penn. or Westmoreland coals to the bench, each four hours, until the retort in dip was unable to do its share of the work, from formation of hard carbon, while the others remained free from such accumulation. The only appearance of deposit in the retorts, is a scale slow of formation and easily detached, leaving the retort entirely clean; a specimen of this scale is herewith presented for inspection, its designation by the School of Mines, Columbia College, N. Y., is "*Papyrocarbon.*"

The design of Gibson's invention is to retain the dip-pipe seal at all times, and to make use of the valve only, when most advantageous to do so; after a retort

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has been charged, for a moment or two the action of the dip-pipe seal is used, to show that the luting, the joints and the retorts are free from imperfections; then the valve is opened, and the exhauster retained at vacuo on the hydraulic main, for the first three hours; during the last hour the illuminating power of the gas in the retort, having fallen below the standard, the valve is closed, to enable the production during the last hour to receive the benefit of the dip-pipe seal. When a retort becomes defective, during the time of production, the tell-tale in the retort-house gives the warning; the imperfect retort can easily be discovered and the remedy applied without disturbing the production of any other retort.

During December, 1873, and January, 1874, special comparative tests were made at the Peoples Works in Brooklyn, N. Y., by experts, for the purpose of ascertaining the actual increase of yield and candle power; the ordinary working during the entire month of February, 1874, was also carefully noted and compared with the production by same benches in February, 1873, under supervision of the same engineer, the average result has been to demonstrate an actual gain in the comparative make, and sales of more than ten per cent. of equal illuminating power.

At the Peoples Works at Albany, N. Y., the facility of application was more apparent, two-thirds of the retorts in use having been fitted up in ten consecutive hours. The average yield to date, as compared with the average yield in dip-pipes seal during the past year, being more than 9 per cent. in favor of the valves.

When the valves are used to aid in the joint manufacture of coal gas and naphtha, the yield from coal of fixed gas *can be increased* 30 *per cent. above the maximum by dip-pipe seal.*

This valve, by preventing the formation of carbon, adds about 10 per cent. per annum to the capacity of production from retort; to this add the increase of

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yield per pound of coal carbonized, and gas works thus fitted will be enabled to meet an increased demand without addition to plant. Where the works are fully equal to the demand, the gain is represented by the decrease in the coal used, the less number of retorts required, the reduction in labor and the addition to the life of the retorts.

Mr. Walker—Mr. President: I think members of the Association should be notified beforehand what papers are to be read, so that they may be prepared to discuss them.

The President—My own judgment is that the reading of a paper is the initial step, and that the subsequent discussion is worth fully as much as the paper itself; and I feel inclined to indulge gentlemen in this course, because it seems to draw out all the minute points. I desire to say to the Association, that Mr. Cruse, a German gentleman—a man of great ability—who has erected within our works, during the last year, in one of our vacant places, an apparatus for manufacturing ammonia from the liquor of our works, has prepared a very fine article, as it seems to me (he submitted it to me for inspection) upon purification, as we are practicing it now. I hope Mr. Cruse will have an opportunity to read it to the Association.

Mr. White—Mr. President: I move the Convention adjourn until to-morrow, at 10 o'clock.

Mr. Hickenlooper—I for one would like to see as much time occupied as possible this evening, for if we adjourn over until to-morrow, I fear we shall lose some of our members, and I suggest that Mr. Cruse be invited to read his paper now.

Mr. DeMill read to the Convention an invitation from M. A. Hanna to the members of the Association, to join an excursion party on the steamer Havana, at 3 o'clock P. M., Thursday, and moved that the invitation be accepted. Carried.

A paper was then read on

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Purification.

By Edward F. Cruse, Esq., of Cleveland, Ohio.

The purification of the gas, after its condensation and washing, is principally effected by the use of caustic lime or oxide of iron.

The impurities consist of sulphuret of hydrogen, sulphurous acid, bisulphide of carbon, cyanogen and different cyanides, carbonic acid and ammonia.

Caustic lime, as well as oxide of iron, are very effective agents upon all of these impurities.

The *caustic lime* readily absorbs the sulphur of the sulphuretted hydrogen, forming sulphide of lime, neutralizes the sulphurous and carbonic acid, and forms, with the cyanogen and the cyanides, cyanides of lime. The lime, however, has no effect upon the carbonate of ammonia. But this impurity ought to be removed from the gas, by washing in the scrubber, and only the last traces of it pass over to the purifying boxes, where the moisture of the lime will, of course, absorb some ammonia, but only very little at best.

The bisulphide of carbon will not be decomposed or absorbed by the lime, but passes through all the purifiers and remains in the gas.

The oxide of iron, as a purifier, will absorb the sulphur of the sulphuretted hydrogen, forming sulphide of iron; will neutralize the sulphurous acids and decompose the different cyanides. The carbonate of ammonia will be decomposed, and the last traces of ammonia are removed from the gas by this purifier. But the oxide of iron has no effect whatever upon the carbonic acid, and, as the lime, none upon the bisulphide of carbon.

The bisulphide of carbon, which forms a considerable impurity of the gas, will not be removed by either of these purifiers, and there exists actually no practical way for removing it. But in those gas works where the ammoniacal liquor is utilized and the water from the

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hydraulic main used for washing the gas in the scrubber, the bisulphide of carbon is dissolved in the ammoniacal liquor, and does not pass over to the purifying boxes at all.

Comparing the effect of the lime and of the oxide of iron, we find that they are about equally effective upon the sulphides and cyanides in the gas.

The ammonia is not absorbed by the lime, but by the iron, and the carbonic acid is not affected by the iron, but absorbed by the lime, and both are equally uneffective upon the bisulphide of carbon.

The lime, after its power is exhausted, becomes useless, and causes only expense for removing, and trouble on account of its obnoxious smell and poisonous gas which it exhales.

The oxide of iron after being removed from the boxes, undergoes a revivification by the mere exposition to the air, and is soon ready to be used again. The chemical process is simply this. The sulphur from the sulphuret of hydrogen is combined with the iron to sulphide of iron, which is a very changeable compound. If exposed to the air, one-third of the sulphur will be set free; and the other two-thirds will be transformed into sulphate of iron, or copperas, merely by the absorption of oxygen from the air.

In this way the exhausted oxide of iron, after being exposed to the air and decomposed by the oxygen, is brought back to the boxes as a mixture of oxide of iron and copperas, and it is by the copperas that the ammonia of the gas is absorbed. The sulphuric acid of the copperas forms sulphate of ammonia, and sets the oxide of iron free to absorb sulphur again from the sulphides in the gas.

The purifying power of oxide of iron will last a very long time, and only be limited by the accumulation of sulphur. As said before, one-third of the sulphur is set free at every revivification, and this sulphur accumulates

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in the mass, so that in a very long time it can amount to 60 per cent. of the whole.

Iron and lime are both very good purifiers, but the lime can only be used once, and is thus practically very expensive. The iron can be used over and over again, but does not affect the carbonic acid in the gas, and has, if used alone, another considerable disadvantage. That is, the oxide of iron will not very readily absorb the sulphur from the sulphuret of hydrogen, if the whole mass is not in an alkaline or at least neutral condition.

The copperas is a very unsteady and changeable combination, and there is always great danger that the neutral condition of the mass will be changed into an acid one, and, in this way, diminish the absorbing power of the oxide of iron for sulphides.

This fact accounts for the very irregular results which are obtained by the use of oxide of iron as a purifier, and has led to the use of the well-known combination of Laming's mass, who first used oxide of iron and caustic lime together.

A very good way to prepare Laming's mixture is this: Take equal weights of caustic lime and sawdust, and mix them thoroughly. For this purpose the lime ought to be sifted in order to keep all the lumps back and use only the fine dust. Then put in the same weight as the lime or sawdust of copperas, dissolved in water, and expose it to the air for at least 24 hours. If the copperas is dissolved in boiling water the whole amount can be mixed at once; if not, it must be done in smaller portions, waiting till the solution is absorbed by the sawdust and lime.

In this way, the purifier consists of equal weights each of sawdust, copperas and lime. After it is mixed, the caustic lime will decompose the copperas and form sulphate of lime, the protoxide of iron of the copperas will absorb oxygen from the air, and form a very finely divided mass of oxide of iron. This can be observed by the brown color which the whole mass assumes.

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Copperas needs only one-fifth of its weight of lime for this decomposition. Laming's mass, ready for use, consists of a mixture of oxide of iron, sulphate of lime and a large excess of caustic lime.

The gas passing through this mass will give its sulphur to the oxide of iron, the sulphate of lime will absorb the last traces or carbonate of ammonia, forming sulphate of ammonia and carbonate of lime. The caustic lime will absorb the free acids. But the principal effect of the presence of lime is the alkaline, or at least neutral condition of the whole mass, without which the absorption of the sulphuret of hydrogen by the oxide cannot take place in a very satisfactory way.

Except, as said before, on the bisulphide of carbon, this mixture of lime, sawdust and copperas, has an excellent purifying effect upon all the impurities. As long as there is any caustic lime left, this purifier will indeed be the most perfect one; and even if all the caustic lime is turned into sulphate of lime, this sulphate in absorbing the ammonia sets lime free, ready to absorb again the carbonic acid from the ammonia in the gas.

After its use, this mass in its chief elements will consist of sulphide of iron and carbonate of lime. Exposed to the air, the sulphide of iron will undergo exactly the same reaction as the oxide of iron mentioned before. One-third of its sulphur will be set free, and the rest of it will form the original copperas again, by absorption of oxygen from the air. Now, the *essential point of the presence of lime* is that the carbonate of lime will decompose the copperas, forming sulphate of lime and oxide of iron, which will be, in its original condition, very finely divided and very effective upon the sulphuret of hydrogen.

Now, practically, if a suitable iron ore can be bought cheaper than copperas, there is, from a theoretical view, no objection why half of the weight of the copperas could not be substituted by ore or iron borings. In

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such a case a mixture of 33 per cent. of lime, 33 per cent. of sawdust, 16½ per cent. of copperas, and 16½ per cent. of iron ore, would have just as good results.

But, of course, the iron ore is very variable, and its effect depends on the percentage of oxide of iron and of its divided condition.

The most perfect purification of the gas would be obtained by the use of the mixture of lime, sawdust and iron in the purifying boxes, and the use of a very small quantity of lime, either dry or wet, afterwards, for neutralizing the carbonic acid.

This purifying process, combined with the use of the ammoniacal liquor in the scrubber, for removing the bisulphide of carbon, would furnish the purest gas of the highest illuminating power, which can be manufactured practically and very cheap.

The thanks of the Association were, on motion, tendered to Mr. Cruse, for his able paper on the subject of purification.

Mr. Nettleton—Mr. President: I believe I am appointed Chairman of the Committee on By-Laws. The committee have conferred together, and have come to the conclusion that it would not be best to undertake to prepare a set of by-laws to be reported at this Convention, and we have concluded to ask of the Convention the liberty of reporting at the next meeting of the Association, probably six months hence.

The President—You have heard the request of the committee to have until October to make their report.

Gen. Hickenlooper—Mr. President: I offer the following resolution, and ask that it be referred to the same committee:

Resolved, The members shall consist of the Presidents, Vice-Presidents, Secretaries, Treasurers, Engineers and Superintendents of all regurlarly organized and operative gas companies of the United States, who may become members by assentin gto this Constitution and the payment of ten dollars annually.

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Mr. Denniston—Mr. President: I would move that the powers of the committee be enlarged so that they may not only prepare a code of by-laws, but revise the constitution.

Gen. Hickenlooper—I accept that modification.

Mr. Buxton—Mr. President: It seems to me that is opening the door. As I understand it now, the members of this Convention are such as are sent here by gas companies, with authority. It seems to me that the gas companies should control each of these members; but by that resolution any officer of any gas company is a member of this Association on paying ten dollars, whether that gas company wants that officer here or not. My understanding is, that any gas company can delegate three persons and no others.

The President—The proposition is to submit this whole matter to the committee.

Gen. Hickenlooper—Mr. President: I am very glad the gentleman (Mr. Buxton) has said what he has, for his idea is exactly the idea I propose to combat; that is, that it requires the indorsement of a gas company to become a member of this Association. I claim the right, if not indorsed by that company, to become a member of this Association. I claim we are an Association for the purpose of becoming educated. I am not the property of any gas-light company—they do not claim me as such. I am not getting this education for their benefit, I am getting it for my own benefit. If members have the same understanding in this matter that I have, then it is eminently proper that we should not be indorsed by our gas companies.

Mr. Denniston—I do not represent a gas company here. I was not authorized by a board of directors to come here; but I presume they will be quite willing to pay my expense if I choose to ask them to do so. I do not hold the same opinion with the gentleman (Gen. Hickenlooper), that I am here only for my own benefit.

Gen. Hickenlooper—Mr. President: I will qualify

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that statement and say that I am here first for my own benefit, and then for the benefit of my company.

Mr. Denniston—Mr. President: I hope that the constitution may be revised in this respect, for the very purpose of preventing these companies from keeping merely their own men here. If we want to be represented by talent, any person who is engaged in this business should have the privilege of becoming a member. We want their information and knowledge.

Gen. Hickenlooper—Mr. President: Another thing I want to mention. For example—I represent the largest gas company represented here to-day. We are entitled to three persons. Smaller companies for the same purpose only one. Whereas, we should pay $30 and smaller companies only $10. We get three times the advantages that smaller companies get, and are three times as large.

The President—My attention has been called to Article 14 of the Constitution on amendments, as follows:

"This constitution may be amended at any annual meeting, provided notice of the same shall have been given, in writing, at the previous annual meeting, or by unanimous consent."

The resolution was referred to the Committee on By-Laws, with instructions to report such changes as it saw fit, subject to the approval of the Association.

Mr. Nettleton—Mr. President: I would say that if there are any members who have propositions to amend the constitution, I will be obliged to them if they will submit them now, or send them to me at New York.

Mr. White—Mr. President: I now renew my motion to adjourn until 10 o'clock to-morrow morning.

The President gave an invitation to members of the Convention to visit the Cleveland Gas Works in a body, and half-past 8 o'clock, Thursday morning, was fixed upon by general consent to comply with the invitation.

On motion of Mr. Nettleton, the names of F. W. Gates, Henry Thompson, and Thomas Littlehales, of Ontario, Canada, were added to the roll.

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The Convention then adjourned until 10 o'clock, A.M., Thursday.

THURSDAY, MAY 14.

The President—As I anticipated last evening when we adjourned, we are fewer in numbers this morning than we were yesterday. There may be other members scattered about the city who will yet be here. There are still many matters that might engage our attention; and now, what shall be the order of business?

Mr. Nettleton—Mr. President: I would suggest whether it would not be well for the Convention to take up the subject of the place for our next meeting this morning.

The President—That is an important question, and will take some time to dispose of it.

Mr. Steel—Mr. President: Are there no more articles to be read?

The President—I have prepared a short article on coal, but believing that this closing session would be short, I have left it at home, and cannot therefore read it. The discussions which we had yesterday, after the reading of the several papers, seem to have made a very pleasant impression upon all the members, and if any gentleman wishes to take up any point that was then dropped, a few moments might be spent very profitably in that way. But perhaps we ought first to discuss the question of adjournment. Some of the members will be leaving before a great while. The question is—to what place shall we adjourn when we do adjourn? We all know very well the circumstances under which we decided, last October, to come to Cleveland. We then thought it would be necessary to make this a Western Institution. We thought we could not rely upon much co-operation from the East, but we have been pleasantly surprised by the presence of members from the East—some from New England, New York, Brooklyn and New Jersey; and the feeling of many seems to be

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that we shall succeed in building up an association which shall embrace the whole of the United States and the Canadas, to be called the American Gas-Light Association. We will now take up the question of adjournment. To what place shall we adjourn for the annual meeting, when we adjourn?

Mr. DeMill—Mr. President: I move that when we do adjourn, we adjourn to meet in the city of New York. I would state that at the last meeting fourteen States were represented by thirty-five delegates, and at this meeting there are eighteen States represented and fifty-five delegates.

Mr. Steele—Mr. President: Haven't we an invitation to meet at Chicago?

Mr. Walker—Mr. President: If we have no invitation to meet at Chicago, I would mention Milwaukee; but as long as Chicago is mentioned, it will not do to speak of Milwaukee. I think the idea of going off to one side to the city of New York is simply absurd; for my part, I object to going to Chicago on the same account. I think the place of meeting should be more central.

Mr. DeMill—Mr. President: If any member has any other place to suggest he is at liberty to do so; he is not obliged to go to New York. The fact that New York is mentioned does not prevent us from going to Charleston, if we conclude to go there. We had delegates from Florida. We know we have in New Orleans—we might go there. There are many arguments that would influence me to go to some other place, still I am at present in favor of going to New York.

Mr. Spencer—Mr. President: I move to substitute Chicago for New York.

Mr. Nettleton—Mr. President: I suppose it is proper to speak to the whole question, but of all the places that are named, I should rather be confined to the amendment in the discussion. I live in New York, and I prefer that the Convention should come there. When the meeting was there last fall the gentlemen who came there

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from the West were very much disappointed. They thought they were received very coldly, and I believe they were. I believe they did not feel any more than they had the right to feel. I think there was a misapprehension on the part of the companies of New York —of the people engaged in the manufacture of gas in the city of New York, not only there but in the surrounding cities. They had very little knowledge of this Association, and of the advantages to be gained by it to the country. Now, I want the Association to come back to New York City once more. New York is the heart or center of the gas manufacturing interests of the country. Information and intelligence I do not say is greater there than at other places; but there are other considerations in favor of going there. The managers of gas companies throughout the country will sooner or later come there and they will arrange their business so as to come there at the time of this meeting. I want to get the heart right: when you get that healthy, then the institution which grows up around it throughout the country will be healthy too; and after that, the meetings of the Association can be held anywhere with advantage. So far as I am personally concerned, I shall use my best endeavors to get the city companies in both New York and Brooklyn to join heart and soul and give us their best efforts, best information and judgment and best results. Another reason why I want the Association to come to New York is, I want to have New England with us. New England is a busy hive of gas companies. We were pleasantly surprised to see gentlemen from New England here—to see Mr. Dwight and Mr. Sherman here. It is a forerunner of what we can get in New England. New York is within distance to draw in all the intelligent and active men of that section of country. I want to bring them in. They can come to New York. Another thing—it is within reach of our Canadian friends; I want to see them there. I trust we may be able to learn a great deal from them. In connection with this,

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and as chairman of the committee having the Constitution under revision, I will say that I approve of the suggestion made by the chairman (Mr. Price), that the Association shall hereafter be known as the Gas Light Association of America. (Applause.) We want to begin at the heart, as I said before, and have that right. Another thing—if New York shall be decided upon as the place for the next meeting, it will be necessary to have a slight amendment made to the Constitution. When that is determined, I will bring that amendment forward.

Mr. Sherman—Mr. President: I would move as an amendment to the original motion, and as a compromise of this matter, that we meet at Pittsburg. Pittsburg is central and has plenty of Monongahela. (Laughter.)

Mr. White—Mr. President: I would like to urge the original motion to adjourn to meet at New York. Nearly everything that is worth seeing—everything relating to our business—is there in perfection. The gentleman suggests Pittsburg. The Monongahela of New York I know to be none behind her's. But aside from that, I think New York offers inducements in a social way that the smaller cities do not afford. There is something there for every man, let his tastes be what they may. It will afford members the opportunity of seeing all the latest improvements of machinery in our line. I know it is considerable of a tax of time and money to gentlemen in the West to come so far, but I think the visit pays them after they get there. I was requested by the president of my company to name our city (Brooklyn) as the place for holding our next meeting, and in doing so I also have his permission to say that we should be very happy to entertain any of the engineers who come there, and to place everything at their disposal to make it pleasant. We should endeavor to do our part in showing them around, and give them all they want to eat in the way of a ban-

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quet, and also all the Monongahela they want to drink. (Applause.)

Mr. Walker—I do not know why I should be more backward than the rest of you. New York, Chicago, and Pittsburgh have been mentioned. Now, I like Milwaukee. I do not know whether there are any Dutchmen among us, but we have first-rate lager beer (laughter)—the best in the country; it is shipped from there all over the country. I move we adjourn to meet at Milwaukee.

Mr. Dunbar—Mr. President: If it is in order I would like to make a motion as an amendment to an amendment, that when this vote is taken it be taken by ballot, and that each member write the name of the city to which he votes to adjourn upon the ballot; and I would name the city of Indianapolis as a very proper place. Its location is central, and is large enough to entertain as many gentlemen as will be present on that occasion. I cannot very well speak for the people of Indianapolis, not being a resident there. It is in the State in which I reside, and the Association would find many things there of interest. It is a very accomplished western town. The gentleman from New York, I presume, is aware of that fact. We come together for the purpose of getting information, and we can do that as well in the West as we can in the East, if our eastern friends will only meet with us.

Mr. McIlhenny—Mr. President: Before the list closes—I do not like to be behind other gentlemen in a matter of courtesy—I would like to suggest another place before the enumeration stops—Washington City. We can show you, perhaps, more in Washington than can be shown in any other city in the Union—a very much improved and beautified city, with the finest streets in the world. You can ride over streets smoother than this floor, with grass plats and fountains, I mean cold water fountains (laughter), all over the city. Then there are the public buildings—various points of interest, as you all know. I suggest that as one of the number.

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Mr. Steele—Congress will not be in session in October.

Mr. Dwight—Mr. President: As a place for holding the next meeting of the Association I would name Boston. It would give us great gratification to meet you there. We have an Association called the New England Association, which has been in existence for some years, and we have received great benefit from it. I met with this Association, at its commencement, in New York. There were then difficulties in the Constitution that did not meet our ideas. We felt at the time that we could not connect ourselves with the Association, that is, we could not go forward and pledge our companies; we could pledge ourselves but not our companies, and for that reason we have never taken a part. But I now find in conversation with the gentlemen who have this in charge that there will be a change in that respect, and I am very happy to hear of it; and, speaking with reference to the next meeting, of course we would be pleased to see you in Boston, yet I do believe New York is the place under all the circumstances, and I shall exert myself all I can to bring in the New England men. There is a large number of men throughout our States, and very few of them have connected themselves with us. We have a gentleman representing Connecticut here, and four from Massachusetts, still that is a very small number; but if we can have the next meeting at New York, and have all the arrangements as they should be, our New York friends will take hold in a different way from what they did before. I am satisfied that the Association would then start off as it should start, and that it would be an Association we should all be proud of. It will be the means of gathering information in regard to our business, which we all require and all want, for that reason I sincerely think that New York is the place for our next meeting. (Applause).

Mr. White—Mr. President: I indorse what the gentleman (Mr. Dwight) says. So far as our engineers are concerned, I have taken the trouble to go among them

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and talk the matter over. The treatment this Association received at the hands of the New York engineers last fall, no one more sincerely regrets than myself, and that treatment will never be repeated. We shall all be most happy to see you there. We all know that the interests in New York are such as to attract you all; and let our future annual meetings, at least, be always held there. Let New York be the headquarters of the Association.

Mr. Spencer—I will waive my preference for Chicago, and be in favor of New York as a place for holding our annual meeting, and I should be very glad if our next semi-annual meeting thereafter should be held at Chicago.

Mr. Nettleton—Mr. President—My idea was to hold our next annual meeting in New York, consolidate the institution, show to the gas engineers of the country that we have something really valuable, and then we can afford to go anywhere, and I thought Chicago would probably be the next place after that.

Mr. Walker—I will withdraw my motion to meet at Milwaukee.

Gen. Hickenlooper—I desire to say that I would be very happy to extend the courtesies of Cincinnati to the Association. We have there all the accommodations to be wished for at any place, and, in addition to the rest, we have a hall of our own and a room below that would serve as the place for holding the banquet. While I am personally in favor of New York as the place for holding our next meeting, I hope you will not feel yourselves committed to Chicago for the next meeting thereafter.

Mr. Nettleton—Mr. President: I suggest that the Secretary call the roll, and that each member as his name is called, name the city he prefers.

[All the places mentioned for holding the next meeting were withdrawn except the city of New York].

Mr. Nettleton—Mr. President: I move that all pend-

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ing motions be laid on the table for the present. Carried.

Mr. Nettleton—Mr. President—I find that Article VIII. of the Constitution reads in this way: "There shall be an annual meeting of the Association to be held on the third Wednesday in October of each year, at such place as the annual Association may have selected; but such annual meeting shall not be held twice, successively, in the same place; except by a two-thirds vote of the companies represented at such previous meeting; and there shall be also a semi-annual meeting on the second Wednesday in May of each year, at such place as may be designated by the Association." I find then in Article XIV.—"This Constitution may be amended at any annual meeting, provided notice of the same shall be given in writing at the previous annual meeting, or by unanimous consent." I hold that to be the unanimous consent of any meeting of the Convention. That being so, I now propose to amend Article VIII. of the Constitution by striking out in the fourth line of Article VIII. the word "annual." It will then read—"There shall be an annual meeting of the Association, to be held on the third Wednesday of October in each year, at such place as the Association may have selected the previous year; but such meeting shall not be held twice, successively, in the same place, except by a two-thirds vote of the companies represented at such previous meeting."

The President—Do you not want to strike out "the previous year?"

Mr. Nettleton—Yes, sir.

Mr. Severance—Mr. President: It seems to me that has reference to the next annual meeting—that the next annual meeting might change this Constitution. I object very much indeed to this kind of tampering with the Constitution anyhow, and we may be changing it at every meeting if we undertake it in this way. I think the Constitution has been sufficiently discussed already.

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It is now in the hands of a committee for revision, and I have a motion to make which I think will obviate this difficulty, that this Association shall adjourn, when it does adjourn, to meet in the city of Brooklyn.

Mr. Spencer—Mr. President: It occurs to me that the language of this article of the Constitution has not been properly understood. It seems so to me from the reading of it, where it says the Constitution may be amended, at the annual meeting, by notice having been given at the previous annual meeting, by a vote of two-thirds, or by unanimous consent. It occurs to me that the "unanimous consent" refers to the annual meeting. For instance, a motion to amend the Constitution is presented at an annual meeting; if you can get the unanimous consent of that meeting, it can be done, otherwise notice must have been given. I think it refers to getting the unanimous consent of the meeting then in session, and you must give notice at the semi-annual meeting, or at the meeting previous, or get the unanimous consent of the annual meeting then in session.

Mr. Nettleton—Mr. President: I think I now have this right by changing a single word. It reads—"such annual meeting shall not be held twice in the same place, except by a two-thirds vote of the companies represented at such previous meeting." Now, I propose to strike out the word "such," and insert the article "a," so that it shall read—"such annual meeting shall not be held twice, successively, in the same place, except by a two-thirds vote of the companies represented at a previous meeting."

The President—The first question is—whether you can amend the Constitution at this meeting?

Mr. Nettleton—I have not the slightest doubt of it. I hold that the words "unanimous consent" mentioned in the Constitution has reference to any meeting.

The President—That is an open question.

Gen. Hickenlooper—Mr. President: I trust there will be no effort made to amend the Constitution at this meet-

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ing. If we commence patching it in this way it will be an interminable job. It is now in the hands of a committee for revision, and if any member has any amendment to offer, it should be referred to that committee. It appears to me from what I have heard of this Association, that a new era is about to dawn upon us, a greater interest is manifested in its success than ever before; and, in order to avoid the constitutional difficulty in the way of meeting at New York, let us, as has been suggested, hold our next meeting in Brooklyn. We come then within the bounds of the Constitution, and, at the same time, obtain all the advantages that would be enjoyed by holding the meeting in New York.

The President—Is it true that a motion to meet at Brooklyn will overcome the constitutional difficulty?

Several members—Certainly.

Mr. Nettleton—There is no doubt that going to Brooklyn overcomes the constitutional objection.

The motion to meet at New York was withdrawn, and the Association decided to hold its next annual meeting at the city of Brooklyn, N. Y.

Mr. Nettleton—Now, Mr. President, there is one more thing that ought to be disposed of, and might as well be done now as at any other time, and that is, the printing of our proceedings, and supplying the same to the members of the Association and others; and my idea is this, that the Secretary of the Association be instructed to have the proceedings of this Convention, as taken by the reporter, printed in book or pamphlet form, to be supplied to members of the Association, as many copies as they choose, at cost, and to be sold to other parties who may desire, at a certain advance over and above cost; and I now make a motion to that effect, that the Secretary of the Association be directed to cause the proceedings of this Convention to be printed in book or pamphlet form, and supplied to members of the Association at cost, as many copies as they see fit to take,

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and to be supplied to other parties at an additional cost of 25 per cent.

Gen. Hickenlooper—I heartily approve of the motion. I made the same suggestion yesterday, but was met with the statement that an entire report of the proceedings would be published in the *Gas-Light Journal*, and that that would probably cover the case; but in addition to that, it would be well to have the proceedings published in volume for reference, and I would suggest that as the proceedings will be published in the *Gas-Light Journal*, they will have the matter set up, and that the committee having the matter in charge could probably obtain from them much more favorable terms.

Mr. Nettleton—Mr. President: I had anticipated that state of things when I made the motion. I had supposed that the *Gas-Light Journal* would be the parties who would contract to print it at a less price than anybody else could, because they have the facilities to do it. I am aware that the proceedings will be published in the paper, but we want it in book form, so that we will not be compelled to wade through the columns of a paper to get the proceedings of the Convention. I think every member will find that he will save time in looking at the proceedings of the Convention by having them in book form, and then let the proceedings of each Convention to be held hereafter, be published in the same way, through the succession of years.

Mr. White—Mr. President: Even as a matter of courtesy, the *Gas-Light Journal* should have the publication of our proceedings. They have been very liberal in securing a stenographer to take down verbatim all our discussions—have shown a very liberal spirit in all their dealings with the Association, and I think this matter should be placed in their hands, a committee being appointed to make arrangements for the publication of our proceedings at as cheap a rate as possible.

The President—With the consent of the Association,

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I would ask Mr. Sanderson about how rapidly the proceedings will be published in the *Gas-Light Journal.*

Mr. Sanderson—Just as fast as possible; about four or five pages each issue.

The President—How long do you think it will take?

Mr. Sanderson—I cannot tell until I get it all from the stenographer.

Gen. Hickenlooper—Mr. President: I desire to make a motion, that a committee consisting of Mr. Nettleton and Capt. White, be appointed to procure the printing of the proceedings of this meeting, with full power to act—leaving the character of the work, the manner of its performance and its appearance, to their discretion and judgment.

Mr. Sanderson—I think the publication in pamphlet form had better be delayed until after their appearance in the Journal, for the reason that there may be some mistake, which members may desire to have corrected.

Mr. Nettleton—That will delay it too long.

Gen. Hickenlooper—Mr. President: I think it would be very unjust to the *Gas-Light Journal* for us to publish the proceedings in advance of their appearance in the *Journal.* I think our interests are identical, and that we could not get along without the aid of the *Journal.*

Mr. Nettleton—Mr. President: I will withdraw my motion.

Mr. Severance—Mr. President——

Mr. DeMill—Mr. President: I object to this method of proceeding. Motions are made, one after another, and not seconded, and it is utterly impossible for me to get a record of them.

Mr. Severance—Mr. President: I beg pardon, but I desire to call Mr. DeMill to order. I have the floor.

Mr. DeMill—Mr. President: My point of order is that there is no question before this body.

The President—On what ground?

Mr. DeMill—On the ground that it has not been reduced to writing and seconded.

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The President—There is a motion before the Convention, and it has been seconded.

Mr. DeMill—What is the motion?

The President—The motion is that Mr. Nettleton and Mr. White be a committee, with full power, to procure the printing of the proceedings of this Convention in pamphlet form.

Mr. DeMill—Who made it?

The President—Gen. Hickenlooper, of Cincinnati.

Gen. Hickenlooper—Mr. President: I desire to amend the motion and put it in different shape—in connection with the secretary. I realize now, since the secretary has spoken, the utter impracticability of the committee's proceeding without his aid. It was entirely a matter of oversight on my part; the secretary certainly ought to be a member of any such committee.

Mr. DeMill—Mr. President: I did not speak with reference to being named on that committee; but I do speak with reference to the matter of making motions and discussing them by this body, without their being seconded.

The President—The motion was properly seconded.

Mr. DeMill—Mr. President: I have not got it.

The President—No motion is in order unless it is in writing; it is a matter of convenience as well. All resolutions should be reduced to writing.

Mr. Severance—Mr. President: What I was going to say is this, in reference to the connection of the *Gas-Light Journal* with these proceedings. There are gentlemen here who are probably taking the London *Journal of Gas-Lighting*, and all are aware, of course, that it has come out in double edition, and increased in size, and increased in—

The President—Are you talking to the question?

Mr. Severance—I am, sir. I am saying that the interest shown for the London *Journal of Gas-Lighting* has helped to double its edition; that they print an edition once a week, instead of printing it once in two

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weeks, and if we can help the *Gas-Light Journal* in this country, increase it in size and in quantity of reading matter, we are benefiting ourselves, and, therefore, we should do all we can to sustain it.

Mr. DeMill (reading the resolution offered by Gen. Hickenlooper)—*Resolved*, That the Secretary, Mr. Nettleton, and Capt. White, be appointed a Committee on Publication of Proceedings of this Meeting, with full power to act.

The President—With the consent of the Convention—I hope Mr. DeMill will excuse me—I would make a suggestion to Gen. Hickenlooper: that the order of the names be reversed, because Mr. DeMill lives in Detroit, and New York is the place where the printing is to be done—by placing the name of Mr. Nettleton at the head of that committee.

Mr. Severance—I move to insert into the resolution, "and the proceedings of the previous meeting."

Mr. DeMill—I have the record of the proceedings of the meeting in October. I think if these proceedings are to be published they should be published in the way they were in the London *Journal of Gas-Lighting*, published right along consecutively; but I understand the gentleman representing the *Gas-Light Journal* to say they cannot do that; and if it is broken up into small paragraphs, as proposed, we shall get it sometime about the annual meeting. How soon does the Convention expect this resolution to be complied with? How soon will Messrs. Nettleton and White be able to get it printed? I would like to know that.

Mr. Nettleton—All I can say is, the committee, if they have the power, will use their best efforts to get it out at the earliest practicable moment.

Mr. Walker—I understand the gentleman connected with the *Gas-Light Journal* to say, that there will be several pages of the proceedings printed in each number of the journal until it is completed. That is exactly the way the London *Journal of Gas-Lighting* does;

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continued as a story from one number of the *Journal* to the next.

Gen. Hickenlooper—Mr. President: Another thought has just occurred to me, during this discussion. Gentlemen who desire that the proceedings of this meeting be published, desire no doubt that they be as full as possible, and it occurs to me that it is utterly impossible to do that without reference to the employees of the *Gas-Light Journal.* Without their assistance, as I understand it, no report of this meeting could be published; therefore, it not only devolves upon us as a matter of courtesy and right, but as a matter of absolute necessity, to apply to them, the managers of that Journal.

Mr. Severance—Mr. President: I move that the records of the previous meeting be inserted with the report of the proceedings of this meeting.

Gen. Hickenlooper—Mr. President: I accept the amendment proposed by Mr. Severance, that the proceedings of the previous meeting be published with the proceedings of this meeting.

Mr. Severance—Mr. President: It might be done in this way. Instead of saying "previous meeting," say the records of the Association, and then let the committee put in whatever they can find.

The resolution of Gen. Hickenlooper, with the amendment proposed by Mr. Severance, was adopted.

Mr. Nettleton—I have one more subject to bring before the Convention and then I am through. This matter of revision of the Constitution. I would like to ask the Convention whether they have any instructions to give the committee, or whether the committee are to take the whole Constitution into consideration, and present substantially a new one. Notices of amendments are required to be given at a previous meeting, or they may be made by unanimous consent. If there are any instructions to be given I would like to receive them.

The President—It seems to me it would be exceedingly

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unwise to enter upon a question of that kind. If we enter upon it we shall find ourselves at sea, and cannot adjourn to-day. I hope the committee will not ask for any instructions.

Mr. Hague—Mr. President: If it is in order, there are one or two things I should like to hear from gentlemen in regard to. There was a little informal discussion this morning among members about cement and leaden joints. I would like a little information upon these points.

The President—Who will undertake to give his views upon the comparative value of cement and leaden joints?

(Several members—Mr. Walker!)

Mr. Walker—Mr. President: I do not know why I should be called upon before anyone else.

The President—Because you have experience.

Mr. Walker—Mr. President: My experience in cement joints has not been very extensive. I use lead in all underground work; I use cement all through the works—everything in the works, from the first joint above the retorts until I pass the meter and get underground to go to the holder. I use ordinary cement (waterlime) also Portland cement. My mode of making cement joints I described to some gentlemen this morning. I find joints to be very thoroughly protected by cement made in that way, where they are above ground. I have objections to using cement underground, as there is no chance for expansion or contraction. In making cement joints I just put in sufficient packing, to prevent the cement running into the pipe, then putting on a clay roll, same as for lead, pour in the cement, allow it to set a little, then remove the clay and finish with a trowel. I have found it satisfactory on all joints around the works. In making joints on the hydraulic main, I use trunk board packing soaked in cement, and it is the easiest and best joint I ever made; but underground, where pipes are exposed to such variations of tempera-

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ture as we have North, and where pipes are apt to be moved by filling trenches, I object to using cement, for the reason that the joint will break with the least movement before it is thoroughly set; and I have found in some instances that the pipes were parted about one-quarter of an inch, and without any depression, showing clearly to my mind that the break was caused by contraction; we have found several this spring in this condition. Where the temperature is more uniform this would not be likely to occur.

The President—Some gentlemen are accustomed to using Roman cements in making joints. We would like to hear from them.

Mr. Hyde—Mr. President: We use Roman cement around our works, and use lead on the streets. There is not much difference in the cost.

The President—Will some gentleman who is accustomed to using Roman cement underground, give his experience?

Mr. Hague—I have laid five miles of pipe with Roman cement, and I have had some broken mains. I think I would have had them with lead joints in the same position; but I wish very much to hear from other engineers to get their experience. My experience with Roman cement joints has been good.

Mr. Dwight—I use Portland cement, some engineers use common cement. I have twenty-seven miles of pipe laid down with Portland cement joints, and, of course, our soil is a very good soil for pipe—it is a loam-sand; but my loss last year was five per cent., showing that we must have pretty good joints. We never have any difficulty with them at all, not when they are well made. I used to use what was called the Roman cement, but for the last five years have used Portland cement entirely. I use the Portland just around our works, every place I can get at conveniently, except where there is a close place, then use a lead joint.

Mr. Hague—Do you use two packings or only one.

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Mr. Dwight—Two.

Mr. Walker—I first used two packings, and then I began to wonder why I did it, and now I find it easier to use only one.

Mr. Dwight—We have a small tin dish in which we mix the cement, have a small trowel to put in the first packing, drive up the first packing and then pack with cement.

Mr. Walker—How deep do you lay your main?

Mr. Dwight—Our mains are laid on an average of 3 feet deep.

Mr. Walker—Do you ever find the frost underneath them?

Mr. Dwight—Yes, sir; clear down below.

Mr. Walker—Do you ever have your mains to break?

Mr. Dwight—I have had the mains break but not the joints.

The President—That raises the question—whether if you had had a lead joint would the main have broken?

Mr. Dwight—I never had but two mains to break in the last 15 years in the whole city, so I do not think I have been troubled very much with main breaking.

The President—What was the cause of the break in those two instances?

Mr. Dwight—It was the settling of the ground in particular places.

The President—Was there any contraction or expansion?

Mr. Dwight—No, sir; nothing of that kind.

Mr. Nettleton—I used Roman cement in laying some seven or eight miles of pipes; and, in the cold weather a year ago, in two places the pipe was drawn right in two, I was satisfied, by contraction; I said to myself I would make no more cement joints underground. I used lead from that time forward.

Mr. Walker—I had two pipes break precisely from the same cause, only two and a half feet underground at that time. I was just going to say that the mains we

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found broken in that way were not broken by the settling of the ground; they were on solid ground and parted as Mr. Nettleton says.

Mr. Nettleton—The difference between Roman and Portland cement is this: Roman cement sets a little quicker than Portland, but the essential elements of each are precisely the same.

Mr. Coombs—I would like to ask Mr. Dwight a question; I believe you stated, your waste was 5 per cent. in street mains.

Mr. Dwight—Yes, sir.

Mr. Coombs—I would like to ask about what your yield per pound of coal is?

Mr. Dwight—I do not know that I care very much to be catechised on that point. Our yield varies of course. I have been averaging 4·60 and 4·70 a pound, often 4·80.

Mr. Coombs—Could you state about how many thousand feet you lose per month to the mile on your mains?

Mr. Dwight—I cannot answer that question, I have no means of knowing.

Mr. Robinson—I would like to inquire of those who use cement, whether they use it pure or with an admixture of sand?

Mr. Walker—I use it pure in my case.

The President—Mr. Dwight, what is your practice?

Mr. Dwight—My practice is to use it pure.

Mr. Robinson—We have always used Roman cement for joints. Our pipes are laid at the uniform depth of three feet. The soil there is gravelly and solid, and the joints, when examined, have very generally been found to be entirely tight. The first few miles of pipe that were laid at Columbus, by the contractor who erected the works, were laid with lead; and at the time the mixed pavement was laid over our principal streets, those joints were dug down to, examined and tightened, and cement put on. We found that a great many of the joints (lead joints) were leaking, as was shown by the discoloration of the earth around the joint; and, by

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that examination, we came to the conclusion that the cement joint answered our purpose best. We have had Roman cement, had some year before last with which we could mix from one-third to one-half pure lake sand. It would set quick enough, and would do just as well; but we could not use anything but the purest lake sand.

Mr. Walker—There is one objection to using sand—the tendency being that the joint may become porous.

Mr. Robinson—That was the objection to the sand in our vicinity, but the lake sand we could use.

Mr. Littlehales—Mr. President: There is another question, that of wooden pipes, in which I feel a great deal of interest; and if any member has had any experience with them for any length of time, I think it would be to the advantage of the Association if he would state the results he has gained. We have laid a short distance of it in Hamilton, as a matter of experiment—about a mile and a half, or something like that—and, I believe, so far it is perfectly tight; but, as to durability, of course that remains to be proved. I understand that in a number of towns in the States a quantity of wooden pipe has been laid, and some gentlemen here may have some experience on the subject; no doubt the Convention would be pleased to hear that experience, because, if wooden pipes are a success, gas works can be constructed at a very much less cost.

Mr Spencer—On the question of joints—a very important question—(before this other question is considered)—I have had a little experience in the use of both lead and cement; used lead formerly and cement for the last two years; and while Mr. Nettleton has had pipes broken square off with cement joints, I have not had; hence, I do not think it will do to come to a conclusion from any one experience in regard to these things. I have laid perhaps a mile and a half or two miles of pipe, a part with Roman and a part with Portland cement, and the most of it was laid before the excessive cold

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weather of a year ago this past winter. It was all gone over this spring, and only one or two leaks were found in the whole of it, where the joints were used up, the rest of it remaining intact even in our cold climate.

Mr. Walker—Mr. President: With reference to wooden pipe, I have had very little experience in using it; but I have seen a good deal of it used, and the objections to its use that I have are these—that any material used for the conveyance of gas from the works to the burners, that requires any gum or resin, that naphtha will dissolve to make it gas tight is unfit to be used for that purpose, as whenever the gas reaches this material it will dissolve it, and a leak may follow, and the dissolved tar or asphaltum cement, with which the pipes are coated, when dissolved will flow to the drips, and render it impossible to pump them. I have also had this experience with cast iron pipes that were coated with this cement, which may be of benefit to some people; the tar being in the joints it was supposed by us that pouring the lead in very hot would clean it out; it did not do it, and although the pipes were tested with water, and stood a pressure of forty pounds to the square inch, and I have never seen tighter joints, yet the tar in the joints dissolved and ran out, and in a little more than a year they had all to be gone over again. I got myself into considerable trouble with this wooden pipe business, by stating this fact to a gentleman who came to consult me on this subject. I believe they have abandoned the use of tar in the inside of the pipe. In the northwest, where I come from, two or three companies use tamarack logs, and I certainly would prefer that to the manufactured pipe. Another point: they lay those tamarack logs in a soil that is wet all the time, and that is greatly in its favor—I would not like to lay them where it was dry—and these men claim very little leakage from it. I have no doubt about this manufactured pipe being gas tight when it is laid, but wherever gas reaches the bitumen or tar cement in any shape it will

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clean it out. I know that in one place where they put it on the joints they had to dig up and relay them. Another instance of where they put down wooden pipe, the tar dissolved and ran into the drips and gave a great deal of trouble. I have had the same trouble with iron pipe tarred inside.

Mr. Severance—Mr. President: There has been one point dropped, and that is the question the gentleman from Youngstown (Mr. Coombs) asked. It seems to me it is an important one—What is the leakage per mile? I have no doubt there are parties losing enough in a mile of pipe to get a good square dinner. It is a very important point to know where it is. This matter of joints and cement bears upon it. Now, a good many of us have had losses to the extent of 25 per cent, or 30 per cent.; we want to know how to overcome that. The gentleman from Youngstown (Mr. Coombs) wanted to know of Mr. Dwight how much he could get out of a pound of coal; and Mr. Dwight did not care to be catechised upon that point. Now, Mr. President, that is what we are here for; we want to get this information—want to learn something. I came here for that purpose. Now, I will give my experience with cement joints, but I may say that it does not amount to much. With the use of Roman cement joints I have found a good many leakages, but by the advice of Mr. Hyde, I have gone over the ground and examined the joints with a steel bar, casting it down into the ground, and with a light, have very soon found out whether there was gas in the neighborhood. I have pursued this course twice a year, and I find it pays—that we can save a little money out of our losses, and thereby afford to sell gas a little cheaper. Now we wish to know how much we can get out of a pound of coal. Some of these gentlemen say a good deal over five feet: another man don't like to be questioned.

The President—This is a little irregular. Mr. Littlehales brought up the question of wooden pipes. If

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any gentleman has any information on that subject, no doubt the Association would be glad to hear it.

Mr. Severace—I beg the gentleman's pardon, but I did not want to lose sight of the other subject.

Mr. Littlehales—If the Convention will pardon me for diverging just a moment, I would like to say but a word about that method of finding out the cause of leakage. I would not do it on any consideration, for the reason that some parts of the pipe may be very thin, and if a bar is put on to one of those parts, what is the result? Instead of discovering the leakage you make it. There is great danger arising from the use of that method, and I would caution gentlemen to be very careful about it.

Mr. Walker—Mr. President: I have used the same kind of a bar for sixteen or eighteen years, and I never have punched a hole in a pipe, and I can find the smallest hole in the street anywhere.

Mr. Severage—There was no motion to take up the wooden pipe, and therefore the other subject was before the Convention, on Mr. Hague's motion.

The President—We had dropped that and the other subject had been taken up. Now, if we are through with the question of wooden pipes, I want to be indulged a moment in a statement. I want to get back to the subject that was mooted yesterday. The reason I do so is that a very extraordinary statement was made to me in regard to the experience of a gentleman of this Convention. He said he did not want to be called out, but I told him I should do it, and he did not very seriously object to it. The gentleman is running a small gas works in this State, uses no exhausters, runs without a dip, without a seal, and has not been obliged to clean his retorts for three years, I told him if he would tell the rest of us how to do it we would be very glad to learn it.

Mr. White—We will give him $50,000 if he will come down to Brooklyn, and teach us how to do that.

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Mr. Reinmund—Mr. President: It is hardly fair to call me out in this manner. When you asked me to make this statement I remarked to you that I came here to learn and not to give my experience, for I did not consider it worth a great deal. In running these one-horse works we are deprived of the talent of experienced engineers; we cannot afford to have them—at least our company thinks so; and we have to work as best we may. Our works were started on the old plan of hydraulic main, and I found when we commenced using clay retorts, that about every two months we had to lay off for scurfing out, and in small works it was no small matter to lose the use of a retort. I determined upon a plan of my own to dispense with the hydraulic main. It is a movable seal attached to the bridge-pipe. Now, I state facts, and do not wish to be catechised; I am not prepared to be catechised. This last fall I shut down two benches of clay retorts; before doing so I remarked to the superintendent that some of my neighbors had insinuated that I was using coal that did not have sufficient carbon in it to cause an incrustation of the retorts, therefore I got rid of the trouble. Now, said I, Mr. King, let us test this. You leave this one bench under seal and work the other without a seal, and in six weeks I could not have run a hundred pounds of coals, whereas the other run two hundred pounds each charge, right straight along. Those retorts were used—one of them nearly three years—one bench—and the other a little over two years, and I pledge my word there never was any carbon collected upon any of them.

The President—Describe your system.

Mr. Reinmund—My system is making a dip in the bridge-pipe, between the stand-pipe and the point where the hydraulic main should be. There is a dip in the pipe instead of making a bridge there; there is a dropper (?), and then there is an outside bucket that is governed by a lever. I have seen a plan in Eastern Pennsylvania that has an inside arrangement that leaves the

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bucket above. This of mine is an outside jacket. When the charge is being drawn the stoker raises the bucket, and this seal in the bridge-pipe prevents it going back; and, if in charging, or after having let up he should neglect to unseal it, it will work just the same as the hydraulic main works; but the object is to let the bucket down and give the gas free flow without its coming in contact with any liquor at all. Use no exhauster, and the pressure-guage stands at about 2½.

The President—Have you any guages between the retorts and the rest of your bridges?

Mr. Reinmund—I had a guage there that broke a short time ago.

The President—Will you state what your results were?

Mr. Reinmund—Our yield is about 4·25. We are using a coal that is not generally known as a gas coal. It is a new field in Perry County, close to our place—Straitsville coal. I do not know what, under proper treatment, that coal would yield.

The President—It produces about 3·80 at Columbus.

Mr. Reinmund—I may say that I was the first that used that coal, and I corresponded with Mr. Douty of Columbus in regard to it. One of the proprietors of the coal company said to me, "you have introduced our coal in Columbus."

The President—I would say that Mr. Douty told me two years ago, soon after using the Straitsville coal, that the yield was about 3·80.

Mr. Miller—I would state that I have just finished, having a pressure of 28·10, and on a test I made with this Straitsville coal I got just exactly 3·50, and I do not believe his yield has been over 3·50.

The President—This is a coal which is especially used in blast furnaces; of course there is not so much bitumen in it, so if our friend gets 4·25, it is an extraordinary testimony to the vacuum process.

Mr. McIlhenny—Mr. President: I am really disap-

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pointed at the very strong indorsements of the theory that I presented yesterday. My friend here says that without an exhauster he gets more astonishing results than I had any reason for anticipating, and I think every person that I have heard speak on the subject, has testified that the theory I have advanced is the correct one.

Mr. Miller—Mr. Walker has spoken to me in regard to carbon. I am using what is called Douty's Patent Dip-pipe—the same principle as that of the movable seal, and I find in my retorts more or less carbon, mostly on the top and back end of the retorts, but only a small quantity in comparison to what I found before I commenced to use the patent dip-pipes.

Mr. Severance (to Mr. Reinmund)—You say you make 4.25, now what amount of gas will the meter show?

Mr. Reinmund—I do not think my answer in regard to that would be any criterion at all, for the reason that from the very starting of our works our street main has been leaking, and our loss has been about 25 per cent.

Mr. Nettleton—Has your loss been more or less since you worked in this way?

Mr. Reinmund—Our loss has been less; and here I may come back to the subject of wooden pipes, and say what I had intended to say on that subject. I have for the last six years put down nothing but wooden pipe, and our loss has been less, although our main has been extended some three miles.

Mr. Walker—Mr. President: The question under discussion was the collection of carbon on retorts.

The President—As connected with running without a seal.

Mr. Walker—I was about to suggest that I have in my experience with clay retorts, which extends over some eighteen years in this country, found retorts that collected much more carbon in them than others. I do not know what kind of a retort the gentleman uses. I

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do not want to ask him, and I do not want to tell anything about the kind I use, because I do not want to advertise anybody's property, but I was going to tell you in speaking of running retorts, of one or two instances where they run just one retort; they are 30 by 15, and they needed just about what they would make; and the reason they run one retort is that they did not need to save coke in winter to run with in summer. They make about 8,000 cubic feet in that one retort 15 by 30, and 8 and 9 feet long. They have no trouble in keeping them clean to make all the gas they want. They are in the habit of laying off on the Sabbath, as near as can be done, the 24 hours; and I believe that bugbear of carbon—I know it is an awful bugbear to some—I think resting on the Sabbath has something to do with my not having so much trouble with carbon. (Applause). I am not speaking with reference to the moral side of the question; that is a different thing. I mean that by working six days of the week instead of seven, that I loosen the carbon, and it comes off very easily. For that reason I am not troubled near so much with carbon as other gentlemen, and besides, my men are better, and I get better work out of them; and I do not know but I can make as much gas in six days as some people do in seven, and do it as easily. The men are anxious to get the Sabbath, and work better during the week.

Mr. Steele—Do you make less carbon in the six days than you do if you work on Sundays?

Mr. Walker—I do not attribute it to that, but it is because the retort lays off that I am not troubled with carbon; and my yearly results prove that I do about as well as anybody else.

Mr. Sherman—Do you not lay idle for the purpose of removing carbon?

Mr. Walker—We do occasionally, but it is no trouble at all.

Mr. McIlhenny—Mr. President: I am glad Mr.

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Walker has made the statement that he has. The impression has prevailed from the commencement of his statement that he did not have any carbon; but from the statement he has just now made, his retorts are idle fourteen per cent. of the entire time; one day in seven his retorts are idle. That embraces fourteen per cent. of the entire year that he makes nothing from his retorts, and he says he has a considerable quantity of carbon every six days. Otherwise he has no means of getting rid of the carbon; it accumulates; and the only reason he does not have it in large quantities is because he frequently removes it.

Mr. Walker—That is the idea exactly.

Mr. McIlhenny—Fourteen per cent. of the time lost.

Mr. Walker—That is very clear—fourteen per cent. of the time, if I can so manage it, I do not make gas—as near that as possible. But you can go to any place where that system is practised—go to Hartford, Connecticut, during the years I had charge of running the works there, and see whether they did not realize results equal to that of any other works where the seven days of the week are worked; and I am prepared to show what I am still doing, and I can name other works where I have partially introduced that system of working. I know that in Hartford, Connecticut, I was visited by some gentlemen from, I think, Massachusetts, and they considered that I made quite as much gas in six days as they did in seven. I think the physical condition of my men is better—that they do more work—if they rest on the Sabbath day.

Mr. Hague—Mr. President: I have tried that plan twenty years, and I fully endorse every word Mr. Walker has said in reference to Sunday work.

Mr. Littlehales—Mr. President: This same subject was brought up before the British Association. I believe all were anxious to abolish Sunday labor; and the London engineers agreed to give every possible chance to the effort to do away with it, and they did. I will tell you what the result was:

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Before six weeks had elapsed in the Crystal Palace works, every one of the men asked to be permitted to go on with the work. Why? They stopped on Saturday night and let their fires go down, when they came to take out the clinker about three hours were gone, and they were nearly exhausted. They found it was much harder on them by working under that system, and they unanimously asked to be allowed to go on with the work as usual, for the reason that there was less strain upon them by doing it that way than by letting the fires go down.

Another objection: The charge being left in the retorts some considerable time, a large amount of carbonic oxide gas was given off, all the inferior parts of the gas carbonized into a sulphur compound, and all the retorts had to be charged at once; and then if you don't do that, if you only charge a part of them and leave a part of them for the next charge, then there is a portion standing idle, so they gave it up; and, I believe, in no one of the London works that I am aware of, do they work in this manner, and so far as the laborers are concerned, I believe the unanimous opinion is—they can work more economically, with less strain upon the men, by giving each man every third or fourth Saturday, but keeping the fires going regularly at the same time.

Mr. Walker—I am sorry to hear the gentleman tell us they have returned to Sunday labor in London because it was more profitable; but, in his concluding remarks, he has proved that rest to the man is profitable. If it is a question of profit and loss, the yearly results will determine that very clearly. This gentleman (Mr. Littlehales) says that the men were dreadfully fatigued in cleaning the fires after they laid over the Sabbath. I must say I never had a complaint of that kind from any of my men, and have never heard them express any desire to return to Sabbath labor. I think, on the other hand, I can get my men to work for less pay than is given in other places where they work

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seven days in the week. I have had no trouble, and in reference to cleaning the fire there is no clinker making during the entire time of laying off. The dampers are closed, and there is a man in charge whose business it is to see that the fires do not go down. Now, with regard to carbonic acid and sulphur compounds: My charges do not run any longer than usual, the lids are slacked off at the regular time. I am sorry London engineers cannot get rid of it by slacking off the lids. I simply slack the lids to allow the gas to escape, so that there will not be much chance for air to enter, and leave the coke to remain there till we are ready to charge again.

With regard to the profit and loss of the matter I refer you to the President of our works, and to all the works I have been connected with, where the system of doing away with Sabbath labor has been practised. I am sorry the London people have given it up.

Mr. Littlehales—I would simply say that the London people have given it up at the special request of the men. To my own knowledge they come in a body to the engineer and asked it.

Mr. Hague—Mr. President: There is another reason why those men should come in a body and make that request. I am now and have been engaged in running certain oil wells; and, as a general thing in the oil regions, they ran the seven days of the week. I never have run mine more than six. My men came to me one day, saying—"these wells are being spoiled by shutting down Saturday nights." "Let them spoil," I said. Said they—"We don't want to run a well that is being spoiled." I told them to go and get another job. The fact is, they wanted seven day's pay, and I would not give but six; my wells to-day are the longest lived in the region, and I attribute it to that fact. I have better men—men that would not work Sundays if I wanted them to.

Mr. Littlehales—Mr. Walker speaks in regard to the

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lid being slacked when the charge is worked off, and wonders that the London men had not thought of this; but I think they would not slack their lids if they knew that by so doing they would crack the retorts, and that is one reason, in using clay retorts, why they do not do so.

Mr. Walker—That is a mistake entirely. I again desire gentlemen to look at the yearly results, in works that have been run in this way, in regard to that point, if the retorts cracked. The yield would be very small and the life of the retorts very short. The only difficulty I have found is when my retorts have been running three or four years, even *five years*. In one place I made about five million cubic feet per retort.

Mr. Hickenlooper—Would there be any change in the temperature of the retort?

Mr. Walker—The temperature is higher owing to the coke being left in.

Mr. McIlhenny—Mr. President: I regard this question as one of considerable importance—the question of Sabbath labor. Every one of us who has had a religious education feels inclined to respect that day; but there is an insurmountable difficulty in the way, especially in large cities. We all know that the consumption of gas is very heavy on Saturday night, and, without a very large amount of storage room, it would be almost impossible to keep up with the consumption without working on Sunday. That is the only objection I see to the system—otherwise I think it is very feasible; and if it could be adopted it would be preferable to the present system of working seven days in the week, but I think one difficulty would be a serious one—the great consumption in the large cities, that could not be provided for except by having an excessive amount of storage room. We all know, no matter how well you guard the amount of consumption and supply, that there are times when we will be caught, and that time might be on Saturday night. The weather changes

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constantly, and, no matter how large your storage is, you will be constantly drawing on it under circumstances over which you have no control; and, at the very time your men are supposed to stop, your supply is at the bottom. In small cities I do not see that these difficulties will occur, and I think that the system of resting over one day in the week is a good one.

Mr. Severance—Mr. President: I move that Mr. Walker be invited to prepare a paper, to be read at our next meeting, on this subject.

The President—We have, as yet, taken no action as to the order of business at our next meeting; and it occurred to me, while Mr. McIlhenny was speaking, that the subject, as he just remarked, was one of importance—that if Sabbath keeping can be introduced in the gas business we ought to know it, and I was going to suggest that Mr. Walker be requested to write, and read before the Association in October, an article, giving his experience and views at length on this question.

Mr. Walker—Writing papers is a little out of my line, but I will do the best I can. I would say, before sitting down, that some Eastern gentlemen may have an opportunity of going to Hartford; if they go there, I hope they will examine the company's books during the five years I was in charge of the works, and worked upon that system, and I did not have a very extensive amount of storage.

Mr. Hickenlooper—Mr. President: As ninety-nine out of a hundred of us will not have an opportunity of visiting that place, would it not be well for Mr. Walker to obtain those results, and incorporate them into his paper.

The President—I suppose Mr. Walker will fortify his position by all sorts of evidence.

Mr. Walker—Mr. President: I may say also that I never changed the pay of the men; and when in a neighboring city, two years ago, the men demanded 75 cents more per day, and when there was a great deal of

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trouble with strikes in New York, my men were perfectly satisfied with $5 a month more—from $45 to $50 per month.

The President—Has any one any suggestion to make as to the other topics which it might be desirable to have brought forward at that meeting.

Mr. Hickenlooper—Mr. President: I would suggest that Mr. White be requested by the Convention to prepare a paper on the subject of naphtha gas, to be submitted at the next meeting. Carried.

Mr. Wood—I move that Mr. Price be requested to present his paper on coal at the next meeting.

The President—My only object was to partially prepare the order of business for the next meeting—something that the meeting could rely upon. Of course voluntary papers are always in order.

Mr. Nettleton—Mr. President: An article on leakage or unaccounted for gas, will be presented to the Convention by my son, C. H. Nettleton, of Derby, Conn.

Mr. Steele—I would suggest that some one be requested to prepare an article on purification.

Mr. Hyde consented to prepare an article on purification.

On motion of Mr. White, the Convention adjourned.

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SECOND ANNUAL MEETING

OF THE

AMERICAN GAS-LIGHT ASSOCIATION,

HELD AT THE

POLYTECHNIC INSTITUTE, BROOKLYN, N. Y.,

OCTOBER 21 AND 22, 1874.

MORNING SESSION, October 21, 1874.

THE Association was called to order at 10 A.M., by the President, General Charles Roome.

The minutes of the previous meeting were read by the Secretary and, after correction, approved.

The Secretary read a communication from Theobald Forstall, Esq., dated New Orleans, Oct. 17, 1874, which was ordered on file.

The Secretary read a communication from Colonel R. C. Ward, of the 23d Regiment, N. G S. N. Y., inviting the members of the Association to visit the armory of the regiment. The Association accepted the invitation, and voted to go in a body at 7.30 P.M.

The Secretary called the roll, when the following members answered to their names:

California: W. W. Beggs, San Francisco; Chas. H. Simpkins, Marysville. *Connecticut:* Jno. P. Harbison, Hartford; F. E. Harrison, New Haven; Henry Cartwright, Bridgeport; L. C. Hanford, Norwalk.

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Delaware: Thomas Curley, Wilmington; Thomas J. Lawson, Wilmington. *Georgia:* George S. Hookey, Augusta. *Indiana:* H. Stacey, Indianapolis; Wm. Dunbar, New Albany; H. H. Edgerton, Fort Wayne. *Iowa:* J. N. Coldren, Iowa City. *Massachusetts:* George D. Cabot, Lawrence; H. F. Coggshall, Fitchburg; George B. Neal, Charlestown; George Dwight, Springfield; O. E. Cushing, Lowell; L. D. Rhodes, Holyoke; E. N. Snow, Chicopee; F. C. Sherman, Worcester. *Michigan:* Samuel Lewis, Detroit; P. E. DeMill, Detroit. *New Jersey:* John S. Chambers, Trenton; Joseph P. Gill, Newark; W. L. Williams, Paterson: John W. Bates, Hoboken; George W. Edge, Jersey City. *New York:* Gen. Charles Roome, New York City; J. Herzog, New York City; J. R. Floyd, New York City; P. W. Stebbins, New York City; Charles Nettleton, New York City; J. Balmore, New York City; George Olney, New York City; J. Elliot Condict, N. Y.; T. F. Rowland, Brooklyn; William P. Libby, Brooklyn; Jos. W. Beatley, Brooklyn; W. H. White, Brooklyn; C. H. Stoddard, Brooklyn; J. H. Armington, Brooklyn; F. S. Benson, Brooklyn; H. P. Morgan, Brooklyn; C. A. White, Brooklyn; F. P. Bunker, Brooklyn; Jas. How, Brooklyn; W. R. Beal, Mott Haven; G. T. Sutton, Peekskill; Wm. Cartwright, Oswego; Thos. C. Cornell, Yonkers; Benson Ferris, Tarrytown; E. W. Leavenworth, Syracuse; H. A. Brooks, Albany; Jno. H. Cowing, Buffalo: Wm. Humphrey, Lansingburgh; Isaac Battin, Albany; Matt. Cartwright, Rochester. *Ohio:* Gustavus A. Hyde, Cleveland; W. H. Miller, Columbus; Jos. Light, Dayton; R. R. Dickey, Dayton; Jos. Clegg, Dayton. *Pennsylvania:* Marcus Smith, Wilkes-Barre; W. H. Denniston, Pittsburg; W. H. McClelland, Pittsburg; Dr. Hostetter, Pittsburg; P. Munzinger, Doylestown; J. D. Patton, Trevorton; W. W. Goodwin, Philadelphia, T. R. Brown, Philadelphia. *Rhode Island:* A. B. Slater,

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Providence. *Virginia:* Chas. S. Allmand, Norfolk; Wm. H. Baxter, Petersburg. *Canada:* T. Littlehales, Hamilton; F. W. Gates, Hamilton; E. S. Cathels, Montreal. *District of Columbia:* Geo. A. McIlhenny, Washington.

General Charles Roome, President of the Association, addressed the meeting as follows:

Gentlemen—I did not come here with any prepared address. I presume it is known to most of you that a year ago, broken down in health, I was unable to attend your meeting in New York, and I was obliged to go from home and travel in Europe. I was away all through last winter and until the ensuing summer. I do not know, speaking to gentlemen of the intelligence of those now sitting before me, and engaged in such an important business as we are, that you need any very formal address.

Who are we? what are we? and why are we associated? According to the Constitution as it exists, we are to meet for the purpose of consulting together that we may advance the interest in which we are all so deeply interested. An interest, the object of which is to promote the welfare of mankind and the comfort of every one. That which was years ago a luxury, has become now almost a matter of prime necessity. Our business is purely a scientific one. It is reduced to mathematical certainty. Experiments are made, and costly experiments they are, as you well know. Our object is therefore to benefit those for whom we work, and upon whom we depend. According to our Constitution, we are each to tell the other what we know of the business, we are to have no secrets each from the other. Our works are open to public inspection, and the experiments we make, and which may be recorded here, are the common property of this Association and all who sustain it. Our object is therefore a good one. Of course we are not, and do not pretend to be, a charitable Association. We are spending our own money;

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we are devoting our time and our studies for what? That we may receive a fair return for that which we invest, and at the same time it is to the interest of the public to sustain us, for in sustaining us they are promoting their own comfort.

It is not an antagonistic business. It is a business the prosperity of which depends altogether upon the manner in which it is managed. If it is mere guess work, empirical, it will amount to nothing. That day has gone by in our business. The time has come when all we do must be mathematically demonstrated, and so we provide at great expense in our works, the means of ascertaining that which will produce the best light for the public at the cheapest cost to us, and consequently cheapest to them. Our interests and those of the public are identical. There is, as you all know, a strong prejudice against any chartered company, newspaper editors and reporters, especially having no mercy on such a corporation. They call them monopolies.

Now, there is not the first feature of a monopoly in our business. In the State of New York any five men can in twenty minutes form a gas company, and getting the consent of the local authorities, can lay their gas pipes anywhere. Is there any monopoly in this? And yet these gentlemen are pleased to call us monopolists.

Gentlemen, we are engaged in a laudable, honorable and useful business. We are engaged in a business which must succeed. The world cannot do without it, and we must so manage it that we may gain credit to ourselves. We are trustees. Millions on millions of dollars are entrusted to our care. We must manage carefully, or our offices will be taken from us; and we must do as wise and honest men should do, discharging a sacred trust to those whose means are placed in our hands, and to the public on whose favor we depend. We propose to collect for the information of the members, the laws of the different States applicable to our profession, to enlighten legislative committees and others

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interested, as to the real nature of our business and the modes of conducting it; and although we shall be compelled to repeat over and over again the same old story, we must be patient, for the charges against us are stereotyped, and arise from ignorance of those who not possessing the necessary scientific information are incapable of understanding what they undertake to condemn. I have been before committees of legislatures and of Congress, and for the last thirty or forty years have had to answer the same old charges, and with the same arguments; and so will it be with you, gentlemen, wherever you may go, and as long as you may live. "*Magna est veritas et prevalebit.*" Truth will prevail. But you can make it known only by incessant labor. You must not grow weary. You must listen to the same old story —"My bill was highest where I burned the least. There is no evidence whatever that I burned this gas; your meters amount to nothing." Gentlemen, has not the law thrown around the consumers every protection which can be given. Are we not compelled to use the measure which the State Inspector declares to be a correct measure? And do we not know among ourselves, that there is no article of commerce which is more accurately measured and supplied to the public than illuminating gas? Gold and silver are not more carefully dealt out to them than the gas which is burned in the houses and places of business in this and every other city. We know it. Our customers frequently doubt it. How then can we convince them? What evidence can we give—what security can we afford? There is a gentleman on this floor who was one of those who framed the law which was adopted by the State of New York, and which gave to the public every possible protection. I know the gas meter is a correct measure. I have proved hundreds of meters with my own hand, when I was the engineer of my company years ago, and I can say, as you can say, without fear of contradiction, that there is no measure on the face of the earth more accurate than the gas meter which is

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used by the gas companies of the United States this minute. (Applause.)

Gentlemen, ours is a progressive science. It is idle for us to sit down and say that all we have to do is simply to throw the coal into the retorts and take the gas out. Ours is a business which requires a study and the possession of scientific knowledge. That scientific knowledge we are laboring to possess. We pay for intellect and we use intellect, and the public, as well as ourselves, get the benefit of it. It is to our interest to sell gas at as low a rate as we can afford. "Reduction in price causes increased consumption; increased consumption produces increased profits; increased profits enable prices again to be reduced, thereby benefiting both producer and consumer." It is a system of mutual dependence between gas companies and gas consumers. I was somewhat old in the business before many of you were born, for it is now thirty-seven years since I commenced my profession. Gas was then sold in this city for $10 per 1000 cubic feet. We make more money at $2.75 per 1000 cubic feet than we made at $10. Why is this? Because of improvements in our mode of manufacture. I do not know that it is necessary for me to say anything further than this. Scientific papers will be presented to you. Men here, much younger than I am, who are studying hard, will present their views to you, and aged men who have experience in this business will give you the benefit of their experience. But as we are all working together for the common good—for the good of the companies we represent—and representing the companies, for the good of the public at large, we can do so in perfect confidence. Let us have no secrets from each other—no secrets from the public. When we give them light, let us give them all the light we can, whether it is in our mode of management or in the simple burner through which they feel our pulse.

Gentlemen, I wish you all success. (Applause.)

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The Secretary read a communication from Samuel H. Douglass, of the University of Michigan, dated October 3, 1874.

Also, a communication from P. E. Pebble, of Quebec.

Also, a communication from the Historical Society of Brooklyn, inviting the members of the Association to visit the library of the Society. The invitation was accepted.

Also, an invitation from the Nassau Gas-Light Company, inviting the members of the Association to visit their works. The invitation was accepted.

Mr. Libby, President of the Citizens Gas-Light Company of Brooklyn, also invited the members of the Association to visit their works, which invitation was accepted.

Mr. James How, Vice-President of the Brooklyn Gas-Light Company, on behalf of all the gas companies of Brooklyn, invited the members of the Association to take a ride to-morrow and view the Park, Greenwood and other interesting portions of the city. Also, to visit the Art Gallery, Also, to partake of a lunch at 3 o'clock to-day. All of which invitations were accepted by the Association, with thanks.

Mr. How also invited the members of the Association to inspect the rooms of the Polytechnic Institute.

Mr. Nettleton, from the Committee appointed to revise the Constitution and By-Laws, reported the following amended Constitution and By-Laws:

Constitution.

I. The name of the Association shall be The American Gas-Light Association, and its office shall be in the city of New York.

II. The objects of this Association shall be—the promotion and advancement of knowledge, scientific and practical, in matters relating to the construction and management of gas works, and the manufacture, distri-

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bution and consumption of illuminating gas, to the end that its cost may be cheapened and its consumption increased.

2. The establishment and maintenance of a spirit of fraternity between the members of the Association, by social intercourse, and by friendly exchange of information and ideas on the before-mentioned subject matters.

3. The inducement and extension of more cordial and friendly relations between the manufacturers of illuminating gas and their patrons, based upon mutuality of interests and a recognition by both of the fact that each have rights which the other should respect.

III. The members of this Association shall consist of two classes, active members and honorary members.

IV. To be eligible as an active member a person must be a president, vice-president, director, treasurer, engineer, consulting engineer, or superintendent of a gas company, or an individual manager of a gas works, or a person practically skilled in the construction and management of gas works.

V. Honorary members shall be gentlemen whose scientific or practical knowledge in matters relating to the gas industry, and whose efforts and interests in that behalf shall recommend them to the Association.

VI. Every applicant for active membership shall signify the same in writing to the Secretary, addressed to the Association, indorsed by two active members.

VII. Honorary members shall be proposed to or by the Executive Committee, and notice thereof shall be given by the Secretary to the Association for its action. The election of applicants for active membership, and of persons proposed as honorary members, shall be by ballot, and each person shall receive two-thirds of the vote cast to be elected.

VIII. New members shall be formally introduced to the Association by the presiding officer after being elected, when they shall subscribe their names to the Constitution of the Association in a roll book of the same, and

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they shall each, at the same time, receive a copy of the Constitution and By-Laws of the Association.

IX. If any applicant for membership or person proposed for membership, on being balloted for, be rejected, no notice shall be taken of the application or action on the same, in the minutes.

X. The affairs of the Association shall be managed by an Executive Committee, subject to the control of the Association, by its action in general meetings. The Executive Committee shall be composed of the officers of the Association for the time being, and the President or Acting President for the last preceding year. All questions in Executive Committee shall be decided by a majority vote, and five members shall be a quorum.

XI. The officers shall consist of a President, three Vice-Presidents, Treasurer and Secretary, to be elected annually, by ballot, six members of Executive Committee, and three members of Finance Committee.

XII. The officers of the Association shall assume office immediately after the close of the meeting at which they are elected; they shall hold meetings at the call of the President, or in his absence, at the call of the Vice-President, and make arrangements for carrying out the objects of the Association.

XIII. The President, or in his absence, one of the Vice-Presidents, shall preside at all meetings of the Association and Executive Committee at which he is present.

XIV. The duties of the Treasurer shall be to receive and safely keep all annual dues and funds of the Association; to keep correct accounts of the same, and pay all bills approved by the President or a member of the Finance Committee; and he shall make an annual report to be submitted to the Association.

XV. The duties of the Secretary shall be to take minutes of all proceedings of the Association, and of the Executive Committee, and enter them in proper

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books for the purpose. He shall conduct the correspondence of the Association; read minutes and notices of all the meetings, and also papers and communications, if the authors wish it, and perform whatever duties may be required in the Constitution and By-Laws appertaining to his department.

XVI. The Finance Committee shall meet on the day of each annual meeting of the Association, at least one hour before the opening of the meeting, to receive from the Treasurer a statement of his accounts, and audit the same. They shall hold such other meetings from time to time as the interests of the Association may require.

XVII. The annual meeting of the Association shall be held in the city of New York, on the third Wednesday of October of each year. Other general meetings of the Association may be held at such times and places as shall be directed at the previous annual meeting.

XVIII. At the annual meeting of the Association the order of business shall be:

1. The reading of the minutes of the last meeting.
2. The reading of applications, notices and reports for new membership.
3. The election and introduction of new members.
4. The address of the President.
5. The report of the Executive Committee on the management of the Association during the previous year.
6. The report of the Treasurer.
7. The report of Finance Committees.
8. Reports of special committees.
9. The election of officers.
10. The reading of papers, of which notice has been given to members by the Secretary, and discussions upon the same.
11. General business.

XIX. At other general meetings of the Association, the order of business shall be the same, except as to the 5th, 6th, 7th and 9th clauses.

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XX. The Secretary shall send notices to all members of the Association at least fourteen days before each general meeting, mentioning the papers to be read, and any special business to be brought before the meeting.

XXI. The Executive Committee shall meet one hour before each general meeting of the Association, and on other occasions, when the President shall deem it necessary; of which special meetings reasonable notice shall be given by special call in print or writing, specifying the business to be attended to.

XXII. All questions shall be decided by any convenient system of open voting, the presiding officer to have a second or casting vote when necessary.

XXIII. Questions of special nature shall be decided by ballot.

XXIV. Any member, with the concurrence of the presiding officer, may admit a friend to each meeting of the Association, but such person shall not take any part in the discussion unless permission to do so be given by the meeting.

XXV. All papers read at the meetings of the Association must relate to matters either directly or indiretly connected with the objects of the Association, and must be approved by the Executive Committee before being read, unless notice of the same shall have been previously given to the members by the Secretary.

XXVI. All papers, drawings or models submitted to the meeting of the Association, shall be and remain the property of the authors.

XXVII. Active members shall pay an initiation fee of ten dollars, and the sum of five dollars annually thereafter, which shall be paid in advance.

XXVIII. No member, whose annual payment shall be in arrears, shall be entitled to vote.

XXIX. Honorary members shall not be required to make any payments or contributions to the Association.

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XXX. Any member may retire from membership by giving written notice to that effect to the Secretary, and the payment of all annual dues to that date; but he shall remain a member and liable to the payment of annual dues till such payments are made.

XXXI. Any member may compound for his annual payments by paying fifty dollars in one sum.

XXXII. A member may be expelled from the Association by a report and motion to that effect made by the Executive Committee, at any general meeting of the Association; the vote shall be by ballot, and shall require two-thirds of the votes cast for its adoption.

AMENDMENTS.

XXXIII. All propositions for adding to or altering any of the provisions of the foregoing Constitution, shall be laid before the Executive Committee, who may bring it before the next general meeting of the Association, if they think fit, and such committee shall be bound to do so on the requisition in writing of any five members of the Association. Each member of the Association shall, upon request, be furnished by the Secretary with a copy of the Constitution and By-Laws of the Association, and also a list of the names and residences of the members.

On motion, the President appointed as a committee for the purpose of engrossing the Constitution: Messrs. Nettleton, Neal, Harbison, Leavenworth and Clegg.

On motion, it was voted that the Secretary transmit a copy of the Constitution as amended to each member of the Association, also a copy of the proceedings of the Association.

Mr. DeMill—Mr. President: I desire to return my thanks for the kindness I have received from the starting of this Association in 1872 to this date. Everything has gone on pleasantly from the first meeting which we held in Cleveland. All of the papers which have been

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presented to the Association are here at our feet; also minutes of all the transactions that have occurred from that day to the present moment. I have my report here, which I am ready to deliver over, of all the moneys I have received, and all the moneys I have paid—the balance is in my pocket. There is one thing I have not done. I have charged for my services, on account, $100. At the first meeting in New York we paid the secretary then $500, and his agent or assistant the sum of about $80. I am not here arguing to get a fee at all, but for the gentleman who may succeed me, that the Association may have some idea what I think he should be paid for his services, whoever he may be. I have the impression that from $250 to $300 ought to be quite sufficient at this early stage of the Association. That might not pay for the room that it is now necessary to have. You must have some place to keep these papers. You must have some place so that we can get at the papers when we come to attend the meetings of the Association. All the papers that have been read before the Association are now on file and can be had; and if it is deemed important to print them—and I believe that they ought to be printed, every one of them, for the benefit of the Association—that would incur some little additional expense. Still I think there will be a sufficient number in the Association now, so that the present fee which we have adopted with this Constitution, will pay all the expenses beyond any contingency. Any person, individual or company, that makes an application here for membership has got to pay $10. After that the companies that are represented here and the individuals pay $5 annually. That, it seems to me, will cover all the expenses that need to occur for the next five years at least. I would like very well to have the President refer my report of the moneys that I have received to a committee to report back here this afternoon, that we may act upon it; and I think there ought to be such a committee appointed to examine the report of the treas-

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urer. Having held the office of Vice-President and Secretary and Treasurer without my consent, I feel very grateful for the intercourse I have had with the members, and they will please excuse me if I decline any further services in that direction. I think we can elect in New York, without any difficulty, a man who is fully posted—and I shall not hesitate to name him—who will take good care of the interests of the Association, and we can have access to his place, and that is Mr. Charles Nettleton.

Mr. Harbison—Mr. President: I think that what I said when we were discussing the articles of the Constitution, and the fears I expressed in regard to this matter, are very fully verified by the gentleman's remarks. He says now that it will be necessary to have an office in the city of New York, where all these papers shall be kept on file, accessible to the members who come here; and he also suggests that it will be necessary, as there will be so much work to do, to pay an annual salary of from $250 up to as many thousands to the Secretary to attend to the business. I have understood from some gentlemen who are present, that the present Secretary volunteered his services some time ago as Secretary of the Association, and I suppose there are members of the Association who would be willing to do the business for a year or two at a time, and not expect to receive all the annual payments of members for their services; because if there are seventy or one hundred members of the Association at $5 a year, that only brings in an income of $500, and if that amount is given to a secretary for his services, we should have nothing left to print reports or anything else. I think the office of secretary ought not to be a paying office. It is one of the duties of an active member, and when one man has served a certain time, the office should be given to some one else. That is why I was opposed to having the office in the city of New York. The present Secretary has done well, but we prevent his

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being re-elected by the adoption of the Constitution, which says he shall have an office in New York. It turns him practically out of office. I say it is all wrong in principle to pay money to support somebody in office. It may be all right now, but this is only a starting point, and somebody will be fishing for it by and bye. Some one who cannot get a living in New York or New Jersey will be proposed by some gentleman for the office of Secretary of the Association.

Mr. Leavenworth raised the point of order that there was no business before the meeting, and moved that a committee of three be appointed to examine the accounts of the Treasurer. The motion was carried.

The Treasurer then presented his accounts, and the President appointed as a committee, Messrs. Sutton, McIlhenny and White.

The Association then took a recess until 4 P. M., to partake of the lunch furnished by the gas companies of Brooklyn.

AFTERNOON SESSION, October 21, 1874.

On motion of Mr. Cartwright, the President appointed a committee of five, consisting of Messrs Cartwright, Hostetter, Leavenworth, Neal and Dickey, to prepare a list of officers for the ensuing year.

A communication was read from Professor Henry Wurtz, dated Hoboken, New Jersey, October 20, 1874, which was ordered to be placed on file.

The Secretary read a paper—

ON SUNDAY LABOR,

By JAMES H. WALKER, Superintendent and Engineer of the Milwaukee Gas-Light Company, Milwaukee, Wisconsin.

Mr. President and Gentlemen—

The subject of the paper I am about to read to you is one that we think deserves our best and most anxious

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consideration, especially when we consider the crisis which we have passed through, within the last few years, arising from the contest between labor and capital. We think that as a profession we are more deeply interested in this subject than almost any other class of employers. While gas companies are held by the public to be pre-eminent among corporations for their want of soul, yet that same public expect from gas companies a faithful performance of all contracts made with them, particularly as regards an unfailing supply of that light which is now almost indispensable to existence in any town or city. The tailors may tell you the men have struck work and you can't have your garments, the dressmaker may tell your wife or daughters the same story, and even if the dress were for a wedding, the disappointment would be forgiven. But let the gas company by any such accident, over which they have no control, be unable to supply the needed light, and forgiveness is impossible; they will be pursued in a court of law for damages, which the court will, in its own time, award with a swingeing bill of costs against the company, which will have to pay them.

Now, in order for the future to remove much of that feeling among our workmen, which causes these contests of labor and capital, we must consider another question besides the mere question of money wages, and that other question is the subject of this paper.

That question is—ought the gas-worker to have, like other workmen, his weekly Sabbath of rest from his secular employment?

This question is one of great importance to the moral and mental improvement, and to the physical health and comfort of our employees—and moreover, to the effective and perfect operation of our gas works.

We do not wish to plead for any sectarian views of the Sabbath; we would leave every workman to his own conscience as to how he would improve his Sabbath; but we would gain for him, if we could, the full

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right to have a Sabbath of rest, by abstaining as much as possible from his secular employment on that day, which is the main thing peremptorily and expressly required in the Third Commandment. To keep it holy is left to his own conscience, there, as to the way of holiness—but to abstain from work is expressly required.

It would take very little research among medical authorities to prove that continued daily labor all the year round, without weekly intervals of rest, is a most unwholesome practice. The man who follows his business in such a way, like a bow never unbent, can have no relaxation, and no recuperating spring from unrelaxed toil; the result is that his labor is sickly and languid, and depressing to his whole frame. In such a state it is an utter impossibility that the productiveness of his labor to his employers can be at all equal to the labor of a man who works the same time, say a year, with the proper and necessary intervals of rest and recreation. The latter works with better health and elasticity of spirit, and without the languid and fagged depression of soul and body that comes over the unrested laborer; and the intelligence of the man who has had his Sabbath interval of rest, is active and energetic compared to the man's that is sunk into the stupid drowsiness of unrested toil.

On these points, without troubling you with the many eminent medical authorities that might be named, I would confidently refer you to the evidence of John Richard Farre, M.D., of London, "an acute and experienced physician," before a committee of the British House of Commons, appointed in 1832 to investigate the effects of laboring seven days in a week, compared with those of laboring only six and resting one. You will find it in pages 34 to 39 of the Sabbath Manual by the Reverend Justin Edwards, D. D., and I think it satisfactorily proves all that need be advanced on the subject that a man should have his Sabbath of rest, and to ren-

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der it very desirable by both employer and employee, that the gas-worker should have it.

Again, the man who is wholly occupied for a year without proper intervals of rest and recreation can have no comfort, and without comfort his work can never be so productive as that of another who has the proper intervals of recreations, and time to look after the things that pertain to his comfort. The very fact that one likes to be clean and well dressed of a Sunday leads to habits that tend to comfort and health, which, in the majority of cases, are totally unattended to by the workmen that have no Sabbath, or who neglect the Sabbath and unnecessarily work secularly on that holy day.

There are many occupations that require great exertion of body, of muscle and of strength, and were these exertions continued daily for a year without the weekly, or even greater intervals of bodily rest, they would be destructive of both body and mind, for the health of neither could stand it. The collier, the mason, the bricklayer, the carpenter, the ploughman, the laborer, the digger, the worker in the earth and the sailor on the seas, if by any of these, and many others, the strain of exertion at their labor was kept up daily for a year without the weekly interval of rest, or in the case of the sailor without frequently greater intervals, the result would be, in the majority of cases, ruined health, weakness and premature old age.

In the case of the gas worker it is still more certainly so, for all day he has to work in an artificial and furnace-heated atmosphere, sweating and poking at enormous fires, pulling, lifting, hauling and shoving at enormous weights of coal and coke and other materials, with his every faculty of body and mind on the stretch to see and fix all right, so that there be no danger to himself and others; and all this continued from morning till night for six days in the week—so that, when Sunday comes round, he is in a truly fit state to require that rest of body which the Third Commandment secures to the industry of mankind.

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It is, that these useful workers for the general comfort, convenience, beauty and health of our towns and cities, should have, as much as possible, like almost all workers in other employments, a Sabbath day of rest once a week from their secular employment, that we here speak. We know that in many cases it can only, to a certain extent, be gained by having sufficient storage; but we would have it as much as possible obtained, because it is an indispensable necessity to the health of the workman, and to the greatest profit and usefulness of the works.

There are two contingent arguments—one against, and one for—the workman being allowed his Sabbath in gas works, on which I at present put little stress. My object is to improve the condition of the men we at present have, not to speculate upon the condition of those we may have, when Sunday can be kept in gas works. The opponents of the measure say, that no work on Sunday begets dissipation, but the answer to that is—it is not usually the dissipated that work on Sunday or on any other day if they can help it, and men inclined to dissipation on that day, whether good and industrious men, work on it or not. Therefore, I think this argument for abolishing Sunday with any class of workmen is futile and untenable. Then again, some think that if you were to put an end to Sunday work, a better class of men morally and physically would enter into gas works. It may in some cases turn out so; but I suspect not to anything like the extent some imagine. The men we have are generally good and excellent at their business, which they have thoroughly learned, and it will not be easy for any new hands soon to supersede them—and why should they be superseded? Grant them the Sabbath as other workmen in other businesses have, and it will be seen that in intelligence and physical endurance they will generally more than match any men new to the business that can be found; and that, in fact, nothing but the tear and

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wear of time and age can make room for new men to take their places, just in the same way as in other kinds of work.

It is quite unnecessary in this Christian land to say anything about the means of grace, or of religion, moral and mental improvement, which the securing to the gas worker his weekly Sabbath of rest from secular work would in most cases ensure to him. The gas worker naturally is as ambitious of self improvement as the workers in other employments; and as we well know that for all the givings of the rich to our churches, still these churches (even fashionable ones) make but a poor show, if the givings and presence of the working classes are withdrawn from their support; and as there is no class of workmen, if allowed the time, who would, in proportion to numbers, pay a greater share of attention and support to the religious, moral and intellectual institutions of the land, it is clear that if they had that time, the churches and other institutions for moral and mental edification would be improved by them, as by other workmen, for their own behoof, as well as for that of their fellow citizens and fellow Christians.

There are indeed some men in every country who are so given up to covetiousness and grasping after riches, that they overreach themselves, and labor after their misnamed wealth all the day, and almost half the night, all the year round; and they would have others in their employment do it too if they could, at the lowest wages and for scarcely thanks, thinking they have done a clever thing when their avarice can screw such service out of a man's necessities. But they are the miserable slaves of filthy lucre, the bigoted and superstitious worshippers of the golden calf, the despised and rejected of all workmen, and with whom no workman, good or bad, will remain one hour longer than his own necessities require.

It is needless to appeal to such as these for a Sabbath for any class of working men. They feel no desire for

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such a day themselves, and they cannot conceive why any man should require it. But we appeal to all men whom the love of truth inspires, whom religion, morality and intellect guide in the way of truth and right, and who have any influence or partnership with gas companies and employers of gas workers—that they use that influence to secure to the gas worker, as much as possible, the weekly Sabbath of rest from his daily secular toil.

Having given you some theoretical arguments, drawn from general consciousness and experience, in favor of Sabbath rest in gas works, I will now tell you what my particular experience has been in this matter. And as I have noticed that considerable credit is being given to parties on the other side of the water for being the foremost in the wise and judicious course they have taken in this matter—all honor to them we say. But we can tell you, gentlemen, that away back thirty years ago, a near and respected relative, now deceased, and a manager of gas works, made it a rule that a portion of his men should always have the Sabbath rest, and that no more work should be done than was absolutely necessary to insure a sufficient supply of gas. For twenty years we have made it our practice in this country to give all the rest possible, in works we were running, on the Sabbath.

In the Fall of 1860, I took charge of the working department of a works in a New England State, making about 100,000 cubic feet per 24 hours. The president, a Christian in every sense of the term, suggested that if it were possible to do without Sunday labor he would be very glad, as he considered it a grievous wrong to compel any man in his employ to do that on the Sabbath which would deprive him of the privileges that he himself enjoyed; namely, of the opportunity to worship God according to the dictates of their conscience, and further—the men's pay was to be the same as if they worked the seven days. Now, gentlemen, I

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think that if there be honor due any one in this country, it is to the president of this New England company, for the Christian and liberal manner in which he acted toward the men, setting an example worthy of imitation in this and every other country. His instructions to me were that he wished as little labor done on the Sabbath as possible, and I immediately commenced to carry out his suggestion by reducing the labor (as far as storage would allow) to the work of one man. My practice was to order heavier charges for the last round on Saturday night. When that was in, all the men were to go home but one, who was instructed by the foreman to fire steadily till a certain hour, then to partially close the dampers and strike off the lids as the charges came off, leaving the lids open just sufficient to allow the gas to pass off. The gang that went off at 6 P. M. on Saturday, were instructed at what time they were to come in on Sunday night; the man on duty was informed of this, and his business was to open dampers, (one hour before the men came in) shake up fires and have them in proper condition for cleaning. When the gang came in their first duty was to clean fires and have them well started before drawing and charging, if circumstances required it. The charges were put in as fast as possible, varying the weight, so as to have them come off about the regular time. I have continued this practice since the above-named date, and the results to myself, and the companies into whose works I have introduced the practice, have been entirely satisfactory —and are as follows:

1. I have used clay retorts exclusively, with and without an exhauster.

2. Their life has been from two to three years working time, and the product per retort, (which we think is the proper way to value a retort,) has been from 5,500 to 6,500 cubic feet per twenty-four hours with (for the best Pittsburg or Youghiogheny coal) a yield of from 4·80 to 5·25 cubic feet per pound.

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3. The quantity of coke used when laying off is small; but the temperature of the retorts is almost always higher than usual. The gas is rapidly evolved and though there may be in old retorts a few leaks, they are quickly stopped, and the yield for twenty-four hours is generally up to the average.

4. The men are more attentive to their work—their fires are kept in better condition—consequently we have better heats and better yield per bench and per pound of coal.

5. They do not require to be so constantly watched and urged on with their work, as the more gas in the holders by stopping time on Saturday night, the longer they can stay out on the Sabbath.

6. My men have improved both morally and physically, and when new men are required a better class can be got.

In conclusion, let me advise you to read carefully the indorsement this matter has received, in a communication to the *American Gas-Light Journal* of August 17th, by Theobald Forstall, Esq., General Superintendent of the New Orleans Gas-Light Company. I fully affirm every fact there stated. I would ask you, gentlemen, presidents, directors and superintendents of gas companies, to give this matter your most serious consideration, as one bearing with much greater force on the successful operating of your works than at first sight appears; and further, in the language used in the inaugural address of the president of our sister Association in Great Britain, "It can be done, it ought to be done; and the shareholders, directors and managers who withhold an inalienable right from their fellowmen, which is in their power to bestow, are incurring a responsibility that no man of just and right principles would be willing to bear."

On the conclusion of the reading of this paper a vote of thanks was tendered to Mr. Walker by the Association.

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The committee appointed to prepare a list of officers, presented the following list:

President, Gen. Charles Roome, New York. *Vice-Presidents*, W. H. Price, Cleveland; Elias W. Leavenworth, Syracuse; Oliver G. Steele, Buffalo. *Secretary*, Charles Nettleton, New York. *Treasurer*, P. E. DeMill, Detroit.

Finance Committee, John S. Chambers, Trenton; J. P. Harbison, Hartford; George A. McIlhenny, Washington.

Executive Committee, W. H. Denniston, Pittsburg; George D. Cabot, Lawrence; A. H. Hickenlooper, Cincinnati; Henry Cartwright, Philadelphia; W. H. White, Brooklyn; Henry Stacey, Indianapolis.

Adopted unanimously on motion of S. Lewis.

The report of the committee was accepted and adopted.

Gen. Roome—Gentlemen: You have been pleased to reappoint me your presiding officer for the ensuing year. I was in hope that the adoption of a new Constitution would relieve me from the cares of office. Perhaps the duties are not very great. The state of my health has been very imperfect for the past year. I have suffered very much, struggled very hard; but still, since you have been pleased to replace me here, I thank you, gratefully thank you for the confidence reposed in me, and, with God's blessing, I will endeavor to discharge my duty to the utmost of my ability. (Applause.)

On motion of Mr. Neal, the President asked and obtained unanimous consent to have inserted in the Constitution, Section I, under the head of officers, after the word "annually," the words "by ballot." The President declared the words to be a part of the Constitution.

On motion of Mr. Neal it was voted that when the Association adjourns it adjourns to meet in this room to-morrow morning at 10 o'clock.

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Capt. William Henry White here read a paper

On Naphtha—Its Economy and Value as a Gas Producer.

Historical Facts from its Discovery to the present day. By W. Henry White, Engineer Citizens Gas-Light Co.

Mr. President and Gentlemen: In accepting the invitation of the Association to prepare a paper upon the use of Naptha in the production of illuminating gas, I was conscious of entering upon a "debateable ground" more haunted by spirits of the past than that of Dale Owen, heaped with the wrecks of past effort, strewn with the mouldering skeletons of earnest yet faulty endeavors, and marked "dangerous" upon all its wayside sign posts.

As past failures are not of necessity prophetic of present defeat, it being a natural law that the fairest harvests are reaped from soils torn and fretted by plow and harrow, and enriched by the decay of the residuals of other harvests, I trust I may be able to show you that some worthy results have sprung from many an untoward beginning: and I beg your attention to such thoughts and facts as I shall present upon the subject of this paper. Thoughts that are the result of a patient, untiring feeling of my way into a more thorough and practical knowledge of the value of oil gas, and which have crystallized into facts in whose light and on whose uncompromising strength, I now presume to address you.

Viewed from the stand point of our present knowledge of the manufacture of gas from coal, the maximum yield of gas of a good illuminating power appears to have been obtained, further progress being stayed by the inexorable law of a standard illuminating power. Could this barrier be overthrown, the skill of engineers

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would doubtless point out methods of obtaining larger yields of gas of low illuminating power, from coal.

But this is an unsurmountable barrier, and the fact that the standard of illuminating power will be raised rather than lowered, together with the continual call for a reduction in the price of gas to the consumers, brings us inevitably to the question—How can this difficulty be best overcome? Petroleum and its products naturally suggest themselves as the means of escape from this dilemma, they being at once abundant, cheap, more readily obtained, transported and compactly stored, than the high-priced enriching coals now in use. Considerations touching upon the cost of labor, material and apparatus, may be adduced as enhancing the important claim of this natural oil upon our attention. Still others arise to show the benefits that would accrue from our being thus enabled to lessen the original cost of the plant, and to cheapen and improve the production of gas, thus widening the field of gas industry, and extending to the smaller towns the advantages of this modern necessity.

Enough has been said of late years, to call the attention of the capitalist, the scientist and inventor to this fruitful and fallow field. Indeed, while the earnest searcher for truth in this modern path was but entering into the primary experiments incident to his discoveries, hundreds of charlatans flung themselves into the breach, and have overrun the gas community with undoubted patent specifics for all the ills our industry was popularly judged to be suffering from. Men whose phrenological developments indicated that their enormous "self-esteem, ideality and acquisitiveness" were far in excess of their "perceptive" and "constructive" faculties, hurried from shop and office with revamped English and continental patents to reform any old fogyism yet lurking in our midst, to worry the suffering "gas man" pale and thin, with the details of processes whose merits were in the vocative case. The patent office has

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been alike the tool and victim of these men, and patent rights have been granted, *ab libitum*, to those who unblushingly appropriated and galvanized into life, the dead and buried failures of our gas ancestry, and now offer them to our notice, with an impudence that soars into the region of the sublime, as "my process." I "no further seek his merits to disclose;" you have all met that terrible man who has an important improvement to offer. You have seen the sanguine light of his eyes, heard the unctuous, melliflous tones of his persuasive accents; have marvelled at his elegantly upholstered exterior—known his anxiety to advance your personal interests, not in the way of vulgar bribe—oh dear, no, sir, nothing of the sort—only to open up to you the golden vista of years to come, when his patent shall have been adopted, the gas fraternity saved, and you calmly happy, as the richly rewarded instrument of so much good accomplished. Let me turn from this unpleasant body, and look to the other and earnest worker striving for the solution of this problem, and see if—in the tangled skein, a very Peruvian Quippo of woven snais, the confusion worse confounded of so called oil patents—any good may be brought out of such a chaos.

I will here be, for a moment, retrospective. It may be of interest to know, that years ago, even in the infancy of gas-making, oil contended for the palm with coal, so that to-day, as though to prove the weary proverb, "Nothing new under the sun," we have to deal with no new question. Accum and Peckstone, early workers in and writers on gas, give cuts and descriptions of machinery for producing oil gas, and bear testimony that it was a formidable rival of coal gas. It cropped out in subsequent writers and found supporters in an array of prominent persons and scientists; patents were issued to Messrs. Taylor, Daniell, Hills and a host of lesser lights, covering the manufacture of gas from resins, fats, oils, naphtha and peat, with all man-

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ner of combinations and amusing styles of machinery; nothing of value, unless it was experience, appears to have grown out of all these trials, and "failure marked them for her own." Was the failure inherent in the material, mode of treatment, or lack of proper knowledge on the part of the experimenters? Nobody can tell us, for, apparently, no one has taken the trouble to ascertain. The obituary of those promising schemes were briefly written by Clegg and his immediate predecessors, and looking back to them to-day with hungry, questioning eyes, we mentally repeat the old obituary upon babes early called from life. "If so quickly you were done for, I wonder what you were begun for," and so unsatisfactorily leave the matter to the wisdom of future generations.

The patentees and inventors immediately preceding the present age, seem to have met with no kindlier fate at the hand of fortune, and one scheme after another breaking down, carried with them the hopes of their abettors, and weakened the trust of the gas interest in the ability of any one to produce, in this connection, a satisfactory method of treating oleaginous matter.

The opportune discovery in this country of the existence of inexhaustible stores of petroleum, however, again naturally attracted attention to oil as a gas producer; 'twas then there arose that wild, helter-skelter of visionary schemes referred to. Another effect of this discovery was to bring to the surface a desire on the part of earnest, thoughtful, practical men to put to test their vague belief, that in some way the old idea of the use of oil might yet be reduced to a practical standpoint. This faith has in one way and another found constant expression among us. The continued experiments of American gas experts prove that the idea of oil gas, though apparently committed to the care of enthusiastic amateurs, had always been working its way with quiet energy into the very inner courts, and now springs into life, here and abroad, with a power and an

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unquestionable right of position, that at once lifts it out of the plane of amateur trifling and professional charlatanry. It had but slumbered, as it were, all these years, and on its awakening makes itself felt in the way and manner of that forceful political unknown quantity, so feared and respected by politicians—"the silent vote," and like that demands consideration.

It would, indeed, be unjust to some, did my semi-jocular remarks in opening this paper, convey to you the impression that I believed that no man or number of men had earnestly striven for originality in their endeavors to utilize petroleum and its products. Still the fact that they all seemed to cluster around and cling to the essential features of old foreign patents, and could not or would not advance one step beyond and into the unfathomed depths, is indisputable. I have refrained from referring to names in speaking of these patents, as I neither wish to advertise them, nor do them injustice; many of their mistakes were at least honest ones, while many men whose training and habits did not entitle them to success in any legitimate business endeavored to take advantage of these schemes as a royal road to fortune; hence the whole subject became involved in bad odor, and consequently was long tabooed by all gas companies.

The patents known as the Gale-Rand were really the first American patents to create any degree of attention, and though these contained the vital points of some English and American patents, their experimental trial at Saratoga proved such an advance in the right direction, as to prove a decided gain, even though admitted, for certain reasons, not to have been a commercial success. There were radical errors in the theory and practice of these patents, that have since caused them to be a generally admitted failure. So much enlightenment upon the vexed question of naphtha gas sprang from the many trials made under these patents, that the gas community were prepared to listen with more tolerance, and

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investigate with superior skill and upon more accurate data, the claims of subsequent inventors or patentees in the same line, especially as in large areas of our country, the enormous cost of coal makes such questions and investigations of great economic importance to those who no longer feel immovably attached to coal as the sole source of gas supply. It is impossible to deny, that the results referred to, although not always exact enough for scientific data, still sufficed to indicate that a material difference existed, both as to the quality and economy, in favor of the use of naphtha, as compared with coal, in gas manufacture. These experiments also developed the important evidence that oil gases were of greater value used in combination with coal gas, than when used alone. Their great specific gravity and excess of carbon necessitates that they be diluted by some lighter gas, and containing a large percentage of hydrogen.

The diluent used in their experiments was atmospheric air, which was fatal to combustion and deleterious, in adding to an already excessive specific gravity. It was to this point these patents had led us, and in thus opening the way to future investigations they hold us so far their debtor.

Next in order, I present and consider those granted to Mr. George Olney. Differing in essentials from those of Rand, they gave satisfactory, if not perfect results. In order to mark the difference I will briefly describe the claims of these patents.

It will be remembered that in the Gale-Rand process, the naphtha in the still was first vaporized, either by the application of direct heat or the use of superheated steam; and the vapors so produced converted into fixed gas by passing them through a heated retort, and subsequently diluting them to the required standard, by the mechanical admixture of atmospheric air at the exhauster or meter. Stratification of this air and the naphtha gas always took place, as no chemical union had or could have taken place between them. The

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"Olney Process" also makes use of a still in which the naphtha is placed, and heated by ordinary steam to a vaporizing point—the diluent to be used, be it air, water-gas, or coal-gas of low illuminating power, being forced through the liquor contained in the still. Being thus carburetted, it is then carried to and through the retort, but without carrying any excess of carbon-vapors to be converted into lampblack, or wasted as in the former process; the vapors and their diluents are thus converted into a permanent gas as little liable to condensation or stratification, as is gas made alone from coal after the usual processes of purification are completed.

The results obtained from this latter process are a decided improvement over those obtained from its predecessor. The many important improvements that have been embodied in the patent, and the results obtained at the works under my charge, as well as at other works using this process, will, I think, justify me in claiming for it a fair success. As employed in the manufacturing at my works, I make my coal gas of as low illuminating power and obtain as large a yield as possible. A portion of this gas being thus mixed with hydrogen, or, strictly speaking, water gas, is carried to the naphtha works and forced through the stills, where, from chemical affinity, it takes up the naphtha vapors; being thus enriched it passes through heated retorts forming a perfect chemical union or permanent gas. Its subsequent treatment is simply that now used in the condensation, etc., of ordinary coal-gas.

We have introduced the use of water-gas to increase the quantity of diluting hydrogen, thereby lightening the specific gravity and increasing the calorific power of the gas, that the carbon may be properly consumed and give no smoke at the burner. The result has more than justified the experiment.

As this process of manufacture has been in operation at the Citizens Gas-Light Company's Works for a period

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of over eighteen months, I trust I am able to answer any question or meet any objections of gentlemen present from actual facts, as demonstrated in our daily working.

Permit me at this point to answer some of the leading objections which have been urged against the use of oil for gas purposes.

1st. "Such gas must be more liable to condensation than coal-gas."

2d. "Oil gas will stratify in its storage or distribution,"

3d. "There is a greater loss of illuminating power in the distribution through mains."

4th. "The greater danger in manufacturing."

These objections have become stereotyped to me; still I cannot but believe them to be the honest doubts of those willing to be convinced, and as such will, in like spirit, answer them.

As to condensation. We have been manufacturing the gas supplied in our district, varying in proportion from one-third to one-half from naphtha for eighteen months. Hence the gas has been subjected in storage and distribution to all the variations of temperature and change of weather such a period would naturally produce, yet we find no cause to believe that this gas, properly made, is as condensable as coal-gas; this must be the fact, since the street dips show a marked decrease in "drip-liquor" from what they caught under the old method.

The same facts are substantiated on the question of stratification, none having been observed, though carefully watched for, since we ceased using air as a diluent of the naphtha gas.

The question of loss of illuminating power I have found to be without any foundation. To the eye the gas seemed equally good at all points of distribution. However, not being willing to trust the truth of so important a point to a test so easily led astray, I made re-

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peated photometrical tests of our gas, taken from the mains at various points in the district, on different occasions, in both warm and cold weather, clear and stormy weather, and found in all cases but a trifling variation from that given in the tests made with the gas at the works. The general appearance of the gas in the district supplied, together with the expression of a great majority of consumers, seemingly by nature biassed against any gas company, is no poor test as to its quality; submitted to such tests our gas has proven highly satisfactory.

Regarding the dangerous feature, the general and certainly very natural apprehension is overstrained. The storage of a large quantity of naphtha in steam-tight iron tanks, properly provided with vent pipes; its passage through iron tubing, underground, from tank to still, and its final vaporization in a steam-tight iron still, at low temperature and pressure, does seem to reduce the possibilities of danger to "nil."

As a class we are trained to watch over and protect much more dangerous and exposed portions of our works than any naphtha still or tank can ever be, and have in the large stores of coal on hand, a lurking enemy ever ready to spring into action.

In a paper that will to a certain degree be public, I question the propriety of, and have, therefore, refrained from giving exact figures or details of cost of manufacture, etc. I cannot but consider such data the property of my company as constituting the private records of their business. I am, however, free to say that the company, even in days of cheap labor and coal, were never able to produce gas so cheaply or of such quality as it now does. I may further safely say that we put our gas into the holder for one-third less cost than we ever did or could with coal alone.

These are facts based on our past business, upon which our dividends have been paid, and are in no wise estimates or suppositions.

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I do not claim that such results came to us at the outset, neither had the patentee or ourselves a full knowledge of the capabilities of the gas experimented on, nor the experience we may justly claim for our guidance in future efforts; difficulties had to be met, unforseen obstacles removed, opposing influences counteracted, consumers trained to the change, and ourselves to be educated; the long, weary list of vexatious, anxious hours over the many little points that always threaten defeat in the development of any new plan of manufacture that must be passed. Through all, the certainty of a priceless result has kept us striving.

To-day, with all the success we have gained, we do not claim to have perfected the work, but rather stand ready to give a hearty welcome to the new mind that shall penetrate still further into this field. I have a great feeling of satisfaction and of being fully rewarded for all the trouble and labor I have had, in the pleasure I have of managing so simple an operation in gas production, and in to-day's comfort I really wonder if all the troubles, of which I have spoken, ever arose before me.

The gains from the use of naphtha or oil gas are direct and indirect. Direct, as it touches the labor, coal and lime. Indirect, as it touches the question of repairs, maintenance and construction, preventing the need of large retort houses, coal stores, or large storage capacity.

The labor is reduced nearly one-half, coal more than half, and proportionately larger yields of gas from coal used; as oil gases do not require lime purification, a consequent reduction in use of lime ensues.

The interest saved on money now invested in large supplies of coal, and the absolute saving in weather waste of coal are of themselves no inconsiderable items of gain. The present annual renewal of retort benches dwindles into small proportions before the use of oil. Enough residuals, as coke and tar, are made to sustain the working benches, and yet give a balance for sale.

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In the construction of new plants large savings can be made, as extensive buildings are unnecessary.

But enough; there cannot be a doubt of the economy or value of oil gas as an auxiliary to coal gas. Our present knowledge of its manufacture does not justify us in using it alone to any extensive degree. The present vital need in the manufacture and use of oil gas, is a cheap method of producing free hydrogen for use as a diluent, or the ability so to reduce the gravity of coal gas, that it may sustain that relation more perfectly than at present; for while the water gases now in use aid in the more perfect combustion of oil gas, they detract nothing from its specific gravity, as they bear in them too great a percentage of carbonic oxide.

I have, in conclusion, purposely withheld from urging upon you any comparative results obtained from the two methods of manufacture, or of entering into seemingly learned disquisitions upon the nature of the gas produced from naphtha, as its chemical and physical attributes are subjects of common knowledge among you.

I could not anticipate that within the limits of such a paper, or of your patience on this occasion, that such details could be enumerated as would immediately convince you, or entirely remove your honest doubts.

It will suffice if I have awakened within you a desire to make personal investigations in this direction, in which I frankly admit, that I believe the next great changes in our system of manufacture will occur.

Mr. Lewis, of Detroit, moved that a committee of three be appointed to report to this Convention to-morrow on the value of naphtha gas compared with coal.

The motion was carried, and the President appointed Messrs. Neal, Cartwright and Dwight.

Mr. Neal—Mr. President: I think that the paper presented to us has been exceedingly interesting. It seems remarkable in Brooklyn that there is one company doing so well, and there may be others doing the

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same thing. I have heard of this process of Gale & Rand. I think I went to Saratoga and examined it, and in Brattleboro a similar process, and I was satisfied of its perfect failure. Now the reader of the article has something new, and I suppose that he will be glad to have us visit his works. How is that? Is there anything secret?

Mr. White—No, sir, we have invited you, through our president, to visit our works.

Mr. Neal—I would like to ask the gentleman what yield he obtains from his coal, how much to a pound, setting aside petroleum. Then what is the average candle power of the gas at the works, and at some distance from it.

Mr. White—I will say, in reply to Mr. Neal, that our average yield from a ton of coal is in the neighborhood of about 12,340 or 12,400 feet to the ton; I think that will average about 5·60 to the pound. I do not call it to mind now, but it is just about in that neighborhood. Our general average to the pound is about 5·50 to 5·75. As to the illuminating power, we endeavor to run in the neighborhood of 17 candles, trying to get as near 17½ as possible. The gas was taken from the lamps upon ten different occasions, at different points in the district on the same night. The gas was tested at the works, where it travels fours blocks before it gets to the photometer. In making our tests upon the gas I usually select some time during the hours of supply to the district, so as to obtain a fair test of the gas as actually delivered to the consumer. Upon these occasions referred to, I took at seven o'clock a test upon the photometer. I then sent out into the district men who gathered in bags gas from ten different points which I had selected as giving fair specimens of the gas from different points of supply. The gas was brought back and immediately placed upon the same photometer, and a record kept, and there was but a trifling variation found between the first test and the gases brought in from the district.

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Mr. Neal—The gentleman speaks in his paper of naphtha gas. Do you mean that you use clear proof petroleum or naphtha?

Mr. White—We use naphtha because that it is so very cheap, petroleum of itself would be no inducement; but should naphtha rise to a very high price, we could use petroleum and still use the same process.

Mr. Neal—If the company that I represent were to use that process, would not the cost of manufacture be somewhat greater for the cost of the patent?

Mr. White—The cost of the patents of course would enter in. The arrangements made with other companies have been such, that the cost of the patent has not been great or oppressive in any manner. The parties owning the patent right have been very liberal in their arrangements with the gas companies desiring to use it.

Mr. Neal—I would like to ask another question. Is this gas before us the article you manufacture?

Mr. White—I regret to say that the poverty of this gas is owing entirely to the fact that it is manufactured at the old Brooklyn Works, under the direction of our friend Col. Armington. (Laughter.)

Mr. Cathels—I do not know whether the gentleman is quite at liberty to answer a question that I would like to ask, and that is, if he has kept any record of the difference between the registration of the station meter, and the returns of the consumers' meters?

Mr. White—I will answer that question with pleasure. I have said in my remarks that I consider a great many questions as to the cost of manufacture as being the private property of my company, simply because I knew that that article would be published, at least in the columns of the *Gas-Light Journal*, and therefrom copied in various other periodicals; but I am free to say to the gentlemen composing the Association before me, that the Citizens Gas-Light Company desire to retain from them no facts bearing upon the question un-

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der discussion, and we will give them the figures at our office, with pleasure. Our street lights are rated at four feet per hour. The station meters and the returns received from the street lamps, and consumers' meters in the past year, show a loss, I think, of 3½ per cent—it was less than 4 per cent; that is, the unaccounted for gas was less than 4 per cent.

Mr. Sutton—I think a year ago you used air.

Mr. White—Yes, sir, a year ago we used air, which we were using merely for a temporary arrangement, until we could get our benches for the manufacture of water gas in operation.

Mr. Sutton—Have you discontinued the use of air?

Mr. White—Entirely so, for about a year.

Mr. McIlhenny—Mr. President: I have been very much interested in Mr. White's paper. Emanating from such a source, it not only partook of the beautiful, sentimental, and poetical, but it went further, and enlightened us upon the subject of the comparative value of coal and oil. I think, sir, that it is sufficient to stir up the curiosity and investigative ability of the members of this Association, to ascertain whether or not the sentiments expressed here in this paper are sufficient to justify extensive experiments. There is no doubt there is a very deep and wide-spread feeling now of investigation into the gas question. These feelings, however, arise periodically, they agitate the gas fraternity into various schemes, as our friend chose to characterize them, and are calculated to arouse the energy and inventive genius of those interested in the manufacture of illuminating gas. Such papers are always instructive, and coming from such a source as our friend, they have more weight than they would ordinarily. The paper is distinguished for its beauty. The gentlemen here will recognize the fact that all his acts pertain to that of the beautiful. When you illuminate a place, you always calculate to brighten the objects around you. Sir, if these things can be done more effectually with oil than

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they can with coal, I am certainly an advocate for the oil. However it is a commercial question; one that the capitalists, the stockholders and the officers of gas companies must go into, and with a seriousness that is beyond all mere verbal recitation of results. I say that this agitation of improvement and economy in the production of illuminating gas has been periodical. Since my boyhood it has been a familiar story to me. I have a limited experience in both processes; but I am not here to condemn any particular process. It is certain that these papers that are read here, and the opinions of eminent gentlemen, are calculated to arouse, if no other result will follow, the energy of every conscientious and intelligent gas man who hears them. When a gentleman of character and truth asserts that he can produce, from certain materials, gas of a certain quality for 33 per cent. less than it can be produced from the materials generally used, it is worthy of serious consideration; and I think, sir, that if this subject is pursued, and a committee is appointed by this Association to investigate thoroughly this question, the minds of those who are here now, and those who may hereafter belong to this Association, will be relieved of any question of doubt on the subject; and, of course, if they were relieved of those questions, would at once launch into the manufacture of these cheap and very brilliant gases that are so represented here.

However, there is one serious obstacle in my opinion though this is not a fact, it is simply an opinion—raised against the universal use of oil gas. The production of petroleum, from what I can learn—I take one or two petroleum journals— is not increasing but rather diminishing. If the gas world goes into the use of petroleum, the question arises in my mind—will not the commercial value of this article go up immediately and effectually check its use? There are always certain parties endeavoring to enhance the commercial value of every article. It is argued that the production of this article is inex-

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haustible. The facts show that it is not. No one who is familiar with the production of gas from oil, doubts that it will produce a most excellent quality of gas, that you can produce gas cheaply from oil. That is admitted, I think, by every intelligent gas man; but the question is will the commercial value of that article remain the same, providing it is generally used? Supposing for instance that all the gas companies in this country change their works from coal to oil, how long would it be before the value of that article would be very much enhanced? Besides the cost of production is not so great as people suppose it is. I do not stand here to advocate coal because I have no interest whatever in it. I may have some of the old prejudices in favor of coal that exist among gas people generally, but those prejudices are subject to removal at any time, when the evidences are presented that the supply of material will be constant and the same in price. The supply of coal we all know is abundant, and has been reduced in price. The cost of the production of gas from coal has been lessened and the production has been increased. Now if this permanent and reliable source of production is thrown aside, and the gas fraternity resort to the use of oil, what will be the result? Will the oil remain at a permanent price commercially? I think not. In my investigations on this subject I found that the principal oil merchants in the country refused to contract for two months for a specific price. If that is the case with one comparatively small concern, what would be the result if the whole country used it? I think, sir, this is not a mere scientific question, but it is a commercial question, one that enters into the commercial value of the two commodities. Besides, as I said before, the reduction in the cost of manufacture is not so magnificent as some would suppose it to be. In the production of gas from coal you get a residual product. In the production of gas from oil none of these products come back. Now, sir, until that question is settled, until

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the question of the supply of this article is settled, I don't think that it would be policy in men who have invested their capital in the supply of illuminating gas to the country, to engage in it. I think as an auxiliary, instead of enriching coal, that oil will probably come in and supply the place; but when you commence to make gas of hydrogen and carburet it with oil, you will then stumble upon the greatest difficulty that the gas fraternity ever encountered—that is, the supply and the cost.

These questions are old, older than I am. There has been no improvement in my judgment in the apparatus for making oil gas since the time of Doctor White, in 1834. His apparatus was practically the same as those used at the present day; and, as our friend has poetically illustrated, it is only the discovery of petroleum that has stimulated what he calls the inventive genius of the country, to bring this question forward. If you look over the different contrivances from that day to the present, you will find that they are practically the same. I will take the privilege of alluding to the different processes referred to by Mr. White. The Gale and Rand process everybody understands. I visited Saratoga when that process was in operation. They wrote me a letter inviting me to come. I told them that I had been in the habit of visiting Saratoga for many years, and that I never was more gratified in the world than I was to be invited and my hotel bill settled; but I did not get any response. I went, however, with several gas men, and sitting in front of the hotel, we saw the lamps, and all of a sudden, like a will-o-the-wisp, they disappeared. Well, that was stratification. (Laughter.) I, with several gentlemen, got a room, and we invited the petroleum gentlemen to come forward and give their experience and the cost of production, etc. Now I make these remarks without any intention at all to reflect upon the remarks of my worthy and estimable friend here. In

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these investigations we had the gentleman produce his books, showing the amount of naphtha he used, etc. I had with me the statistics of the cost of gas in Washington, all the items in the cost of production, and we found that with petroleum gas manufactured in this way, 40 per cent. air and 60 per cent. naphtha gas, the difference in the cost of economy would not justify the great risk that was to be involved in lighting a city, because that is a point that the community has a right to be interested in. You cannot experiment on a community that are paying for an article, and expect a good article—you cannot experiment on them in justice. That is to be considered by every conscientious gas company. The result of these investigations in Saratoga, showed that the difference in cost was very small. The result was that the whole thing was finally blown out and they went into the coal gas again. Then again, Mr. Olney's process is a little different, if I understand it. If I am not right I wish gentlemen would correct me. Mr. Olney's process is to produce both gases in the same retort, and mix them there and get all you can from the coal, then to inject the carbon from the oil and make a pure coal gas by the excessive carbon from the oil.

That is the old story of making carburetted hydrogen. It is a mere chemical question whether you can produce carburetted hydrogen from the material that has it, or whether you can make it chemically. You make carburetted hydrogen anyhow in all these processes. Now the question is, can you make it cheaper and better chemically compounded, or can you make it better when Nature compounds it. Coal contains all the elements necessary to make carburetted hydrogen; and the question is, can you make it better when you make it from the natural materials. I am one of those who do not emphatically believe in this age of progess. I think that there are certain things which cannot be done. These are times, it is true, of magnificent enter-

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prises, great undertakings, wonderful discoveries; but, notwithstanding these facts that we see patent before us, in the magnificent discoveries that we suppose to have emanated from this age, I am one of those who believe that they are mere recurrences of the past. Consequently, I do not suppose, when such an abundant supply of coal is put at our command, that any other material will be devised until that is exhausted. These may be considered contracted, narrow views of the subject; however, they will in the end prove to be correct. The excitement in consequence of these various methods for the manufacture of gas from oil, as I said, is periodical. Your experience, Mr. President, is a living testimony to that effect. You have had instances, every four or five years, of the same thing. I recollect when I was a boy, in Philadelphia, when Sander's Water Gas came out. I was then in a very subordinate position in the gas works. The whole country was excited with this idea of making gas from water, and parties in Philadelphia having gone into it, and invested their capital, believing it to be a perfect success, the council in Philadelphia instructed Mr. Cresson, the very celebrated and competent engineer of the Philadelphia gas works, to investigate the subject thoroughly, these works being owned by the city. Mr. Cresson being a thorough chemist himself, after investigating, came to the conclusion that the whole thing was an absurdity, and pronounced against it. To illustrate Mr. Cresson's idea, the Girard House was lighted by the water gas. A chemist from New York—I do not recollect his name—perhaps you can tell me who it was—

Mr. White—It was Prof. Doremus.

Mr. McIlhenny—The hotel was lighted by the water gas. Mr. Cresson said, "If this is a better thing than the coal gas we want to know it," and he sent men there to cut off the supply of the city. I speak of this now to illustrate the result of these things. If I am speaking too long I hope the gentlemen will tell me.

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(Cries of "Go on! You are interesting.") The parties got out an injunction. Mr. Cresson sent 100 men there and cut off the supply anyhow. The result was that the next night the Girard House was in darkness, and the chemist who went from New York (I recollect reading the circumstance with a great deal of amusement) found out that the cock that had the oil on was turned most frequently, and the one that had the water on was turned very seldom. I speak of this now to illustrate what was the result of that excitement. Of course I do not pretend to say that the same result will ensue now, but I do say that there is this to be considered by the gas fraternity, and I am sure there is no gentleman here who has money invested who is not interested in this question, because money will tell upon a man quicker than any other argument. If you can prove to a man that oil is better than water he will go for the oil, but if he likes water in his'n he will take it. (Laughter.) Where coal is abundant and cheap, there can be no question as to the economy of the two different processes. Where coal is high and difficult to procure, there is, of course, some argument in favor of oil. You may make oil gas on a small scale, and make it very successfully; but when you make seven or eight millions of feet a day—when you commence to light a city with these immense proportions, you have to dilute it with hydrogen or air; such hydrogen as you have to make out of steam—and some of them do not make hydrogen, although they think they do. When you do that, I think you will raise a howl in the community that every gas man would try to shun. But as I said before, no gas company has a right to go into these preliminaries until they know that they are a perfect success. They must not trifle with the interests and feelings of the consumers. Consequently, with all the respect that I entertain toward my friend and his intelligence, I do not think that he has convinced these gentlemen here, except in the simple assertion that he

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makes gas thirty-three per cent. less than it can be produced from coal. Now, I would like to ask our friend Mr. White, what would be the effect upon the commercial value of naphtha or crude petroleum, supposing that the whole gas fraternity goes into the business. I hope you will excuse me for talking so long. (Applause.)

Mr. White—It is getting late, and we have to vacate these premises at 7 o'clock to-night. I shall endeavor to be as brief and concise as possible in my reply. I have to thank my friend for his very courteous recognition of the qualities that he supposes to be inherent in that paper of mine. His ringing the changes upon the old story of supply, reminds me of a story told of an old lady who lived years ago, in Philadelphia, when the "black stone," now known as anthracite coal, was first introduced as a matter of fuel. The old lady looked at some of it. She had been used to those wide, hospitable open fire places, in which half a cord of wood had been thrown in at a time, and the flames roared up the chimney, seeming to carry with them an invitation of hospitality spread abroad to all friends and comers. The old lady looked at this little bit of a coal fire in a grate and she said, "Well that may be a first-rate thing for you folks that like to burn *stuns*, but as for me, God provides his forests for fuel and I would like to burn them, lest I be flying in his face." God did provide the forests, but the rapacity of man swept them away. God in his infinite wisdom provided inexhaustible stores of coal too, which lie under us in all directions. They stimulate all our enterprises, they minister to our social needs, they supply our daily wants. The whales that furnished the oil for the lamps of our forefathers were hunted from out the seas. Nature, or God, as we choose to recognize, came to the rescue, and out of the bowels of Pennsylvania and Virginia, and other States, lifted up the oils to replace those that were taken from the bodies of the leviathans of the sea, and do we too

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risk with the old lady the danger in using them, of flying into the face of Providence? (Applause.) The stores of coal, gentlemen, are popularly supposed to be inexhaustible. If we have any geological knowledge, we know that if the stores of coal are measurably inexhaustible, the stores or oil are infinitely so; for wherever the carboniferous influence extends, there also oil will be produced. There has never been a demand in this world that was not met by an adequate supply. It seems to me that right here, in the city of Brooklyn, we can bring to you an illustration of this fact. One man, Charles Pratt, who is a large dealer in oils and the refined products of oil, has furnished, and agreed to furnish, a very large quantity to several of our companies. The Mutual Gas-Light Company—I apologize for naming them in the presence of *regular* gentlemen, but they are a gas company, as my friend, the President, will acknowledge—use vast quantities of oil. The Citizens Gas-Light Company use a somewhat smaller, but still for them, a rather vast quantity. The Peoples Company of this city also use a large quantity, and the Harlem Company of New York also, and yet I assure you it has not raised a quarter of a cent, and we have made a contract—all four companies—with Mr. Pratt, for our supply of oil, at a ridiculously low rate for a whole year, and Mr. Pratt would be very glad to make contracts with all the other companies. As to the production of oil, I can assure the gentleman who has preceded me, that in the oil district of Pennsylvania, of which I know something, there is an inexhaustible store of this very commodity. So anxious are the producers to raise the price of oil in the markets of New York and Philadelphia to-day, that they absolutely stop work on wells, thus making a dead loss, for the simple purpose of raising the price of oil. There is a constant demand in this country for refined oil, which will produce a constantly increasing quantity of naphtha. I did not presume when I read my paper that I should be understood as urging the

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use of oil absolutely alone. I spoke entirely of the use of oil mixed with coal gases, or taking the place of the rich or high-priced illuminating coals. I there advance certain reasons for objecting to the use of oil alone, and present to your minds as scientific and practical men, a field for future development.

I should really dislike to emulate McIlhenny, in acknowledging myself in your presence as being an advocate of a belief, or want of belief in an age of progress. I think that the time will come, and that within the life of every man within the hearing of my voice, that all this cumbrous machinery and vast expensive appliances will be swept away, and our gas be manufactured cheaply, beautifully, cleanly. Do any of you gentlemen, manufacturing gas from coal alone, invite your lady friends to walk through your works as I do? I say to my friends that they can pass through my works without soiling a single white garment. Can you do the same? No, you cannot. My process is the poetry of gas making, as yours is the prose. (Laughter.) And I assure you, gentlemen, that should I conduct you through my retort house, which is now a "deserted village," more suggestive of a past busy life than that of which Goldsmith so poetically sings, and lead you into my naphtha gas works, you would see a nicely dressed contented man, probably smoking a leisurely pipe, looking as if he had nothing on earth to do to earn his daily wages, and yet he is making 300,000 feet of gas. This matter becomes important, Mr. President, on the question of commercial value, as suggested. Touch a man, as Mr. McIlhenny says, upon his pocket, and you touch the most vital instinct of that man. I have touched nine men upon their pockets, and they are pleased with my touching ways. (Cries of "Good!") It is a fact, gentlemen. Now, if these people, after eighteen months of absolute hard work, and spending money in the plans and in the extension of the works for the manufacture of oil gas, can make over and above

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that, the usual dividend, I certainly have uncompromising facts to be presented to you.

Now I candidly say—I did not say it in my paper for the simple reason that I desired to provoke this very discussion—come to our works. We will show you every record we have. I do not publish them as a public fact, but we will be glad to see you and glad to present to you actual figures that you may see for yourselves if I do not make gas better and cheaper than we did before. Mr. McIlhenny, I know, represents a company that does make coal gas better and cheaper than any company that I know of. I speak from the card, for I know whereof I speak. But can any man pay $3.50 for labor and $8.25 for coal, besides paying for everything else in that proportion, and put his gas into the holders for less than ninety cents? I have done it, and I do it as a matter of record. I wish gentlemen to understand that every remark I make now is based upon a dead year; the dividends are paid, the books closed up. Gentlemen can draw comparisons with their own neighbors. I cannot of course compare with companies located in parts of the country where coal is $5 in the sheds and labor $2.25. Such companies must figure from a basis of their own prices, to obtain an idea of the gain to be made in their own cases. We can make no comparisons without being possessed of the facts.

Mr. McIlhenny—Is there any difference now in consumption?

Mr. White—I will say that our district now averages from 4 to 5 per cent. better than it did last year. We ought to add 10 per cent. to our consumption, but the trouble is in the general financial difficulties, and is not chargeable to oil gas to any serious extent.

Mr. DeMill—I would like to ask a single question. The gentlemen says his works are open to everybody. I want to know why it is that right here, in the very city of Brooklyn, where there is one company doing like

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that, other companies have concluded not to use that process, but are using coal—right in his neighborhood, right across the street—new works. I confess that I cannot understand these things, because if that is the best process for making gas, it certainly ought to be the best process in the city of Brooklyn, and the people who are erecting works, it seems to me, would adopt that plan. If that is the best plan, then it seems to me that the Manhattan Gas-Light Company are blinding their eyes in the use of coal. The Metropolitan Gas-Light Company of Brooklyn have erected new works in the last year, and they are making coal gas. I believe the Detroit Gas-Light Company to-day has been for two years in direct competition with this very thing.

Mr. White—I beg pardon. It is not this very thing, but a different thing. You are in competition with the Gale-Rand patent, which is very different.

Mr. DeMill—Well, it is nahptha gas. I know it is better, and why I know it is better, there were gentlemen the day before I left home, put our gas in at $1.50, and they asked them $1 for the other. Now, why is that?

Mr. White—I give it up—its too abstruse.

Mr. DeMill—I will say right here, before I leave, that a vast portion of the gas sold by the opposition in Detroit, is sold by my permission; in other words, if I go and say, "You must take my gas," they will do it, because it is a better gas.

The President—I am satisfied, gentlemen, that we must leave this room now.

The Association then adjourned to meet to-morrow, October 22d, at 10 A. M.

SECOND DAY—October 22, 1874.

The President called the meeting to order, pursuant to adjournment.

The minutes of the evening session were read by the Secretary and approved.

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The President—We left off discussing the Olney process.

Mr. Cartwright—In connection with the discussion of that subject, I observe with some degree of satisfaction, the presence of Mr. President Libby. We heard from Capt. White, I think, all the poetry and sentiment that is possible to be crowded into that subject, and I for one confess to a disappointment, and under the feeling of disappointment, I would like to hear something that would come down to the substratum of the whole concern. We want to look at it in a commercial and practical point of view, and if it would please the Association, and at the same time Mr. Libby would be willing, I would be glad to hear any remarks he may have to offer.

Mr. Libby—I thank the gentlemen of the Association for the invitation they have given me. I do not propose to detain you long, gentlemen, neither do I propose to make what is properly called a speech. If I can throw out some hints on this question, which will be useful, I would be very glad to do so. I represent no patents and no methods. I represent, in what I say, what to me appears to be simply facts and nothing more; and facts that I look at more in a business point of view, than in the scientific light which you gentlemen give so much time and attention to. My attention was called to this subject through what is called the Rand process. I visited Saratoga with one of our most prominent directors—one largely interested in our company, and a man of clear and practical mind. We examined the process there, and he condemned it entirely. I did not. He condemned it so much that he said he would not be willing to use it, or invest any money in the development of it. There were others that were so strong in the idea that there was something in it, that they were willing to risk something in the experiment, and in the development of what was deemed by many to be a grand improvement in gas making. The idea

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which came to my mind was a commercial one. I found these facts existing in the manufacture of gas. That we were paying the Pennsylvania Railroad Co. $6 a ton for transporting a coarse, heavy material, over the Alleghany mountains around to New York; an article that costs $1.50 at its start, $8 or $9 when it arrives here. And when it comes here we use not over twenty per cent. of that product for the purpose of illuminating gas; eighty per cent. freight and expenses were paid on this coarse material, in order to get the twenty per cent. which we really need. It seems to me to be about as wise for an Iowa or Minnesota farmer to send his wheat straw here, and grind it into flour, or as it would be for a Louisiana sugar manufacturer to send the sugar cane to New York, and to manufacture it after it got here, and to pay the freight and expenses on the raw material. It seems to me that we have not yet got to the extent of our possible improvement; in fact, that we work very much behind it; that we ride in the stage coach and canal boat still, instead of availing ourselves of the more rapid transit—the railroad and steamboat. Now, if you take the amount of money which is consumed in freights, you will see that a very important item of the cost of gas is paid to the railroads. Then we come to the labor question and we find as a matter of fact, and facts that cannot be disputed, that the old process at least costs more than twice as much as the new. These two items to a business man are formidable, and the question is—Can they be overcome?

I spoke this morning to the foreman of the department of our works, which is making naphtha gas. Our engineer is familiar with this; it comes to me now, because I spoke to him this morning about it. I said: "How much gas are you making per hour?" He said, "22,000 feet." I said, "Are you averaging 20,000 feet?" He said, "Yes, sir, we did that yesterday." We have four benches which make this 20,000 feet, and multiplied by 24 makes 480,000 in 24 hours. That would be

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our maximum, perhaps, but 300,000 feet would be an easy day's work. It takes about four or five men to do this work. There is no labor in it—hardly any at all. The foreman sits there looking at his machinery, and one man keeps the fires; that is about all the labor connected with it. You can easily understand what it would cost to manufacture 400,000 feet of gas in the old way. You are all familiar with it. This gas we made yesterday is 18 candle power, measured by the photometer, and combined with the coal gas, gave us yesterday between 16 and 17 candle power. I would not pretend to discuss with you, gentlemen, the chemical and scientific questions which relate to this, but in a general way I have always supposed and know that whatever is illuminating is in the carbon, which the oil is largely possessed of. I consider that the hydrogen is a sort of express, to carry along this carbon to the consumers; that it is carried as the sand is carried in the rapid streams, and is consumed at the point of the burner, and from that we get our light. The facts which were brought forward in Mr. White's paper yesterday can hardly be disputed. They are the figures of our workings for a long time, and were simple facts, and pass for what they are worth. These facts seem to me to be very stubborn things, and I think they do not speak in very complimentary terms of the gas fraternity. Your honored and esteemed President, in his opening speech yesterday, stated, and stated truly, that a gas company was not a monopoly. In a legal sense *it is not*, but for all practical purposes *it is a monopoly*. No two gas companies can do business in the same place with profit. One or the other must yield, from the facts and surroundings of the case. Will you permit me, Mr. President, to make a statement, or give a reason, why the gas business must be a monopoly? It arises out of this fact, and I think this fact is universal, that the amount of capital required for a gas company in proportion to its business is so large, that no two compa-

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nies can occupy the same field. Banks, insurance companies, and other business have the world for their field. They can throw enterprise into their business and extend it to any amount; a gas company cannot. Its business is fixed and it is local, and the amount of capital, compared with the amount of its business, makes it differ, it seems to me, from any class of business in the community.

If Mr. A. T. Stewart, after he put a million of goods in his store, had to make a tramway to every customer he has, to send the goods home after they were sold, he would find that he had more money invested in his tramways than he had in the stock on hand; so that if you take the gas interest in the United States with the amount of business compared with the capital, it would not be over 40 per cent.; hence the profit on gas must be very large, in order to pay a fair return for the investment. Mr. Stewart, to carry on the illustration, may turn his stock eight or ten times a year, and if he makes one per cent. each time, he has made 10 per cent. We must make 25 per cent., in order to return the same profit, our yearly business being but two-fifths of our capital. And here is where the public do not understand, and will not understand this question, that the percentage of profit in gas manufacture must be very large, in order to give a fair compensation for the capital invested. This matter of monopoly is an important one, and your honored President will excuse me if I say, that while it is not a legal monopoly (as any one can make gas that pleases) it is practically a monopoly, and hence, unless the gas interest make some improvement—unless they afford a better light and a cheaper light—unless they advance as other departments of industry do, we shall certainly have just complaints against us from the community. I assert here, from what I know, assuming that our gas is a good one (and I have no doubt about that), that there is a very great economy in getting the essential elements of which gas is made,

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upon the spot, without paying this very large amount of expense in getting the coarse material. My own experience in the way of residual is, that those things do not amount to much in the end. They are said to be a profit. I don't think they are a very great income. They are often in the way, and I think that dividends upon residual are something as it was with the Morris Canal in New Jersey, which never paid but one dividend, and paid that by mowing the tow-path and selling the hay. I remember very well an anecdote related by a gentleman from Buffalo, who said that while in England he met an Englishman, and the conversation turned on the city of Buffalo. The Englishman asserted that it was in Canada; the gentleman of Buffalo said, "No, I am an American citizen, and I know Buffalo is in the United States." The Englishman said, "Excuse me, I have no doubt you think so, but still you must be mistaken." The gentleman said, "I have lived in Buffalo for 25 years, and I know it is in the United States." The Englishman said, "Excuse me, I have no doubt you think so, but you must be mistaken." Now, when these facts come out day by day, and month after month, as they do now, it strikes me as strange for gentlemen to get up and say there is nothing in it, as a gentleman from Washington did last night.

The matter of the product of petroleum in this country has been brought up, and that is one that would attract the attention of all business men, and yet you would be surprised (I have not the figures) to see what a very small percentage of the amount of petroleum that is produced in this country, if all the gas companies were to use it, what a small percentage of that whole amount would be used; for it does not take a great deal of these oils to make 16,000 feet or a million feet of gas. We are getting about 130 feet of the average, of this high quality of gas, from one gallon of naphtha, day in and day out. This naphtha now is costing us 5½ cents on a year's contract, and it is easy for you, gentlemen, to state how

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much 1,000 feet of the raw material will cost; if you add that we can make 100,000 feet a bench per day, with four or five men, you will come very near to the cost of naphtha gas. There is a limit, however, when naphtha will advance in price; that we understand very well. But situated as our works are, and as all the works should be situated, it takes only forty-eight hours to get back to coal again. If coal is too high we go back to naphtha.

There is another point in this which is a practical one, and that is, some difficulty which has been had in regard to strikes in gas houses. We had a severe one here in Brooklyn. Now, with us, if a strike should occur, we would take our engineer and clerk and one man, and we will not leave our district in darkness. We can get along. We are independent as far as that is concerned, of these dangerous strikes. I think that is a very important matter. Then again, does it not strike all of you, gentlemen, that to go into a retort house and see the man stripped to the skin—thermometer 100 degrees—with wheel barrows, rakes, hot coke, water and steam, working 24 hours, or 12 hours, each and then cipher down the very small product of gas to the man per day. It seems to be more like the toiling horses on the canal than up to the advanced improvements in other departments of manufacture. I think, with all due respect to the gas fraternity and the distinguished gentlemen who are connected with it, that with long experience they are rather to-day the Marlboroughs in the field than the Napoleons. That there has been a later development of forces that has come to the surface, which must of necessity do away with old methods, while new ones, and more scientific and better systems must prevail. I was somewhat surprised last night at the remarks that our engineer made, in trying to urge this process on you. Gentlemen, I see no reason why he should do so. We are willing to give any information that we have; but to ask any of you, gentlemen,

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to adopt this method, seems to me entirely outside this Association. I would not ask any gentleman here to visit our works for our sakes; we can go on as we are going on. If we are dissatisfied with it we can abandon it, and if we are satisfied with it we can keep on with it. We ask you to come for your own sake, not for ours. I do not know but that we would rather have you go on in the old methods and let us go on in ours. I can see no reduction in the price of gas in this city, so long as the present methods are followed.

I wish to say one word more. We feel very much gratified in having you with us. We hope to make your stay here as pleasant and agreeable as possible. We have a noble city, a noble park; and we have the piers of a bridge, up high enough to show that the foundation rests upon the imperishable solidity of greenbacks. We propose to annex New Nork to this city in about five years, also Jersey City and Westchester, then having a city that we can extend back 40 miles one way and 100 the other. We believe that Brooklyn will be the greatest city in the world when we get all these cities annexed. Nevertheless, we have half a million of population here, and we are very proud of our city; and I think also that it is better lighted than most cities in the Union, at least the southern portion of it. I am quite sure it is; and although there is some little evidence of darkness, yet that would not be visible to New York gentlemen; but we, who are accustomed to a better light, discover it very quickly.

Mr. Nettleton— I want to ask Mr. Libby whether he has made a comparative estimate of the cost of the plant to carry on the naphtha works and the coal works. And one other question—whether the meters are the same, or whether they have been interfered with by the use of naphtha gas?

Mr. Libby—I will answer these questions, especially in regard to the last one. As our engineer said, since we commenced, more than three years ago, if I am not mis-

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taken, we have been experimenting and feeling our way along. While we were using the process in which atmospheric air was a part of the gas, there was more or less difficulty with the meters. Since we have thrown aside the atmospheric air we have had no difficulty. Since I have been in the gas business—which is about fifteen years—our office has never been so quiet; we are having a few complaints, our meters register properly, and there is no trouble in the district. There is another matter, the naphthaline or crystalline deposit which some of our neighbors suffer with, we have none of this at all. We used to be troubled with it. In regard to the point of expense of the naphtha works, it is impossible for me to answer that question, because we had to take the old works as we found them; but it is easy to see that six benches do not cost us so much as 18; and in our retort house, which is 200 feet long, and 65 feet wide, you will see perhaps eight or ten men at work in this whole stretch of retorts, and our consumption is a little under 500,000 feet a day.

Mr. Littlehales—I must confess that I feel somewhat disappointed in reference to this subject. During the last six months, I venture to say, scarcely a day has passed but what I have thought over this question of oil *versus* coal; because I think there is no subject of so much importance—of such intense importance, I might say—to the gas world for two reasons—

First—We want to make more profit for ourselves.

Second—We want to be able to furnish gas at a less price.

Now, any method or process to enable us to do these two things will be the best thing that can possibly befall us. I think so far as the paper is concerned, it leaves us just as much in the dark as we were before. In fact, I don't see that it gives us a single grain of information. We have been told in a general way that gas can be made for one-third less than coal gas. That may mean at one-third less than his gas was made before. That

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may not mean that oil gas can be made at one-third the cost in every place. What we want to know is, the difference in cost of labor, in the cost of raw material, what it will cost at the holder. Secondly, is the outlay for capital counted, or how is that in proportion to what it cost for coal gas. I must say the principal thing that drew me this long distance, was to hear what was said in reference to this oil question. I came with this view, with this object; wanting to make gas cheaper and pay greater dividends, and sell gas cheaper to all parties. If any one can show me a process by which I may accomplish this—I don't want to take it for nothing—I will recommend my directors to give $50,000 if it were necessary, to get hold of it, but I must know first of all, that it is better, that it is more advantageous. If we can get something for $50,000 that we can make $100,000 out of, I want to get it. Then $50,000 profit is made. We were told in a general way last night that it could be made for something like 80 cents a thousand feet, if I understood Captain White aright. I was told by a gentleman yesterday that he could make coal gas for 75 cents a thousand feet. How is that? We want something reliable, and something we can avail ourselves of, and act safely upon. Captain White seems to take shelter behind a screen, it appears to me. He said there were certain facts he thinks profitable to his company. I presume these processes are protected by patents; and if there be no objection that we know what they cost, then we shall know how we are getting on. If he can show us with a raw material at a certain price, then each of us can apply it to our own individual case, and we shall know what we are doing. But in the present position, it seems to me, that we are just as much in the dark as we were before the paper was read. Simple generalities have been presented. We want something more definite, with more information.

There are a few points I would like to ask definite information upon. The committee that was appointed

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last night, it seems to me would be equally unsatisfactory unless they can give us information on these points. One gentleman said they were not allowed to give us the facts and figures. Can this committee give them to us for publication? If Captain White was not allowed to give us the facts and figures, the committee will not be allowed to do so either. If not, the committee will be a perfect farce. I would like to know about those points, and if we cannot have them answered now, I would like to have the committee receive special instruction to get all the information they can on those points. The first is: Captain White says it has only been partially adopted. He said he would not recommend the entire abandonment of the coal process for that of oil. If he would not, why? If the thing is good up to a certain point, why is it not good all the way through? If it was only economical to make one-third of it, what is the reason? There is some reason, let us know what it is. Then we want to know the cost per thousand, subdivided into the cost per thousand for raw material, the cost per thousand for labor, the cost per thousand to the holders; then we want to know the total receipt of the consumer's meters—how much difference there is between the station meter and the consumer's meters.

Then there is another thing. This same system, or as near as I can imagine, the same system of oil process, which, to my knowledge, has been tried in several cases, and in one case known to me, abandoned fifteen years ago. They all seemed to carry out the same idea, getting as much gas as possible from the coal; decompose steam, and take the hydrogen and carbon and mix the two together. They all combined the same principle. I want to know, if this one is a success, wherein is the difference between this and all the others? I have not myself yet heard a single distinction pointed out between these two processes, or between this one and the fifty others that have gone before it. Captain White said last night, that it is a totally different thing

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from that used in Detroit. Let us know wherein the difference is. Surely these things are protected by patent, and if any company thinks proper to take these patents up, let them pay for them. Let us have some firm ground to tread on instead of these generalities. Let us have something more definite.

I may also say that this same thing has been agitated considerably in England lately. And a particular friend of my own, who has had some very considerable experience in it, gave me some facts and figures in reference to it; and although the company at that time was professing to make large profits, it was really costing them more for the gas than they were selling the gas for. I have the figures of what the labor cost, and they were actually selling the gas for less than it was costing them and yet the thing was a success.

A member—Did they make any dividends?

Mr. Littlehales—Yes, sir, they were paying dividends. I want to know wherein this process differs from the dozens that have gone before it. And another thing occurs to me, if this is such a success, and it can be made so cheaply, how is it that these other companies in Brooklyn do not make their own gas from it. I venture to say that if I was in the Brooklyn gas works, and I found that my neighbors could make gas so cheaply, if I didn't adopt their process, I would buy the gas from them. Surely there is some weak point, some screw loose somewhere. It would pay the gentlemen to lay a main across to New York and supply the whole of New York, if they can do something that nobody else can do. I cannot see how it is that your neighbors are all so blind. I want to adopt this if I can. I appreciate the force of the remark of the gentleman that just sat down, as to the severe strain upon the stokers; it is a severe strain, and I would very much like to see some plan by which it can be avoided; if I can do so by adopting a cheaper process, I see a great advantage in it by lessening the labor, for it all comes down to dollars and cents.

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How are we going to make gas cheaper, sell gas cheaper, and make more dividends? A gentleman who has been quoted to me as a great authority on this question, Mr. Edgerton—if he is present, I would like to ask him to give me information on the points I have alluded to.

Mr. Edgerton—I came prepared with a statement which will occupy ten minutes, and which will refer sufficiently, I think, to the naphtha gas question, which has come up within the last four years. Four years ago I made a report upon it, and I will quote somewhat from that report.

On Petroleum Gas.

By Henry H. Edgerton, Superintendent of the Fort Wayne Gas-Light Company, Fort Wayne, Indiana.

Gentlemen: I wish to occupy your time for a few moments to present to your consideration the following facts, not unimportant to you, as the representatives of the gas manufacturing interest. You are all perfectly well acquainted with the details of your own working, in your various localities, in regard to cost of materials, yield, leakage, etc., and all the accounts in fact that lead you to that interesting figure, the profit per thousand feet of gas delivered to the consumer. Very few among you perhaps have tried any experiments, with a view to making useful to you that not inconsiderable competitor of gas—kerosene oil. We had nearly all of us made up our minds, and that too very firmly, that petroleum oil, in every shape, under any name or synonym, was our enemy under all circumstances. Four years ago, the prospect of a rather lively competition with this enemy induced me to reconoitre from a new point of view the position. The conclusions arrived at were embodied in a report, published in the *American Gas-Light Journal*, for April and May, 1871, which report is quite full on the subject.

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The report and the conclusions arrived at, caused the writer to be regarded as a decided renegade and traitor to the gas interest by all the orthodox people who took the trouble to read the report. Very few of you, probably, read it through even if you commenced it. There seemed to be too much nonsense in it. However, I will not trouble you to go back to that, the main conclusion in a nutshell, was this—that the best way to deal with that dirty enemy, petroleum, was to use it up, That is —use it to the extent of establishing an equilibrium between petroleum and coal as a gas producer.

In that report, data were given by which I think any one of you could calculate for himself, the point at which that equilibrium might be established—provided these data were received as true.

We of the gas interest generally, thought this use of petroleum to be too much encumbered by the genius of "patent rights." We are all human, and therefore when one finds himself, as he supposes, the possessor of a new and brilliant idea—the hope of an admiring posterity, duty to one's family and the laws of his country, induces one to rush in and take out a patent. It cannot however be contradicted that collectively we despise "patent rights"—we gas men particularly despise them—some of us may have a remembrance of some other gas man paying for "Gengembre's patent non-freezing, non-evaporating, anti-corrosive, meter liquid," together with an extra meter bill the next year; or for "linseed oil cake purifying compound," one box warranted to last a year without change. This may bring us unpleasant reminiscences—let us pass on to main facts. The writer made sundry obstinate kicks at this "patent right" feature; but adopting the French motto—"against force of circumstances there can be no resistance," he succumbed. Now, representing the principle, construction and running of twenty-two gas works using petroleum gas, both mixed with other gases as well as unmixed, he submits to you the follow-

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ing facts. Ordinary commercial naphtha of average 70° Beaume gravity, makes 80 cubic feet per gallon of 80 candle gas, is composed of a mixture of four gases, when properly made, contains no free hydrogen, no sulphuretted hydrogen, carbonic acid, or carbonic oxide.

It burns at the rate of one cubic foot per hour in a suitable burner, giving a light of 15 candles for one cubic foot; and when free from any undecomposed vapor, the light is soft, brilliant and perfectly free from smoke. The size of flame is 3½″ spread, by 1½″ high. One of the constituent gases is a non-illuminant or diluent—one slightly illuminant—the remaining two, 56 per cent. of the mixture, highly illuminant, of 1·272 specific gravity,

This gas is used unmixed in fourteen cities and towns in this country, at prices ranging from ten dollars to thirty-five dollars per actual thousand cubic feet. About two thousand consumers think this gas a commercial article, and pay for it on the above terms. Among its consumers are stores, hotels, private houses, street lamps, and last, but not least, whiskey shops, houses on the hill, houses in the hollows, with the same pressure. At present prices here, the commercial equivalent of 2½ cents worth of benzine, made into gas, is 400 cubic feet of 15 candle coal-gas.

Thus, you will see that our dirty enemy petroleum is greatly grown in importance with its increased volume.

Some consider that even a good thing may be too strong for weak knees and stomachs, and therefore put water in it. Consequently no less than 28,500 customers of eight considerable companies are consuming this said-to-be uncommercial article, with more or less weakening coal-gas, air, hydrogen, carbonic oxide and carbonic acid in it. Now they like it, seem to burn it, even where they have got a choice of a little more sulphur in theirs if they want it. Notwithstanding the combined efforts of these twenty-two gas companies, with their

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30,000 consumers, and all other ordinary drains on our arch enemy—he still grows on us, as the price goes down lower and lower.

In the ancient times when the big whales tried to beat out Boghead or even Newcastle coal with their oil, aided by those pine country people with their rosin, they totally failed.

Those of the ancient times remember well that fight and with pride too. Now whole counties are spouting oil in defiance; and it does look a little as if oil was raising right up on top of coal.

Then why not investigate and look the matter up fairly, squarely and fully.

To those who have attended to it, are certain they know all about it, I humbly address myself, with a request to compare notes.

If wrong, I am willing to turn again, enter the orthodox fold, turn off that naphtha gas, and quit.

I used to be a good coal gas man, and have an apparatus, very simple indeed, for unsealing the dip on hydraulic mains, and am ready to begin over again if necessary.

In regard to the price of the manufacture of this gas in different localities, and the cost of materials, there are certain fundamental data on which to base your calculations. The cost of labor for making you will have to ascertain comparatively, and make your estimate on it by visiting such works as are using it, and apply to the labor there the price that you are paying for labor. That I think embraces the foundation of the naphtha gas question at present.

Mr. Sutton—I, for one, would like to have information about this matter. I would like to know from Captain White about how he would advise to make gas: how much coal gas, how much hydrogen gas and how much oil. I would like to know what it is, and so would other gentlemen. I want to know the practical part of it. I do not despise information from any source where I can get it.

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Mr. Neal—Mr. President: You recollect at our meeting yesterday, there was a committee appointed on the subject of naphtha gas, of which I am the chairman. When are we expected to report?

The President—It would depend on the committee.

Mr. Neal—Not at this meeting?

The President—It is not obligatory.

Mr. Neal—I have been looking at several works where naphtha is used, and I am entirely in the dark yet, and I do not think we can make a report until the next semi-annual meeting. I would say, as chairman of that committee, that we are not prepared to report—not so well prepared to report—not so well prepared as we were yesterday afternoon. We have been looking into the subject, and we are seeking for light, but we are all in darkness. I speak and act for other members of the committee. I think they are of the same opinion. We ask for further time. We ask permission to report at the next semi-annual meeting, six months hence.

The President—It is moved and seconded that the request be granted. Motion carried.

Mr. Littlehales—I beg that the committee be specially instructed to inquire as to the different cost, so we will have reliable data.

The President—If any one is desirous of drawing the attention of the committee to any particular point, he had better submit it to the chairman of the committee in writing.

Mr. Baxter—I had not intended to make any remarks at this time; but I feel, coming from a portion of the country but little represented here, that it is proper for me to say that I appreciate the attempt of the gentlemen to introduce to us a new process for the manufacture of gas.

While it may be unsatisfactory to us—to very many of us—yet we must feel under some obligation to these gentlemen for introducing this matter for our consideration. The novelty of it takes us almost by surprise,

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and we are unprepared for it. When we make comparisons between our process which we have followed for years, we cannot at first see the great advantage. These gentlemen say they can see it. The company which I represent is one that is doing to-day no larger business than it did in 1860, yet our business is much more profitable to the company by reason of the improvement of the manufacture of the gas and lessening its cost. We are anxious to become more economical in the manufacture, and reduce the cost to the company as well as to the consumer; and for that reason I am here with the hope of gaining valuable information for myself, for the company I represent and for the general benefit of the fraternity in my section particularly. I simply have made these remarks so that I may not be understood as making any reflection upon the gentlemen who have preceded me, or those who represent an interest different from that which I represent. I am anxious to gain information and to make that information valuable to the interest I represent.

We have had some figures presented as to the quality and quantity of coals. I do not know that it is desirable at this time to view them at all, as this matter will be presented by the committee at our next meeting. I had hoped, if it were possible, that we might have a report at this meeting, and the comparisons as to the cost in various parts of the country might be brought before us. It is said that coal in New York cost $8.25 per ton. In some sections of the country it does not cost much more than half that amount—the quality of the coal is perhaps different. The Virginia coal, which I am compelled to use, some 20 years ago, probably you will remember, was rated at about three to three and one-half feet to the pound. We now, under better processes, get from four to four and one-quarter, and in some cases four and one-half feet to the pound. We consider that a great improvement, but we want to do better. The cost of labor is another matter. Here, in your great center of activity,

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parted to it a quarter of a century ago by the genius of labor is costly, while in other portions of the country labor is comparatively cheap. As we met here for information, it is not only desirable that comparisons should be made in the city of Brooklyn, but in other portions of the country. In Virginia we have coal, but not oil. We would have to transport the oil from Philadelphia or Baltimore to the southern parts of the country where we have coal near at hand, so in some portions of the west, the comparison between the cost of coal and oil in those portions would be very different from that of the oil center, and far from the coal center. I hope the committee in making these investigations, and making their report, will take into consideration the various circumstances of the nearness to, and distance from, the various materials.

The process I will not speak of at all. I have had some little experience in these matters in years gone by. They have led me from one time to another to disappointment; and I hope the time is approaching when our disappointments are to end, and we will come to the determination of what is the best material, and that inexhaustible, to make gas of.

Mr. Neal—Professor Wurtz asks the indulgence of the Association He asks that this subject may be laid on the table, to give him an opportunity to say what he has to say, as he has sickness in his family and he wishes to leave. I think that we should allow him that indulgence. Captain White says he wishes to speak about five minutes, then I would ask at the last of his remarks, the subject be laid on the table.

Mr. White—I will make that motion now. I waive any claim to refer to the paper at present, in favor of Prof. Wurtz.

The President—It is moved and seconded that the further discussion of this matter—naphtha gas—be laid on the table for the present. Carried.

Mr. McIlhenny—There is a gentleman in the room

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who can give us some important information about how to make more gas out of a ton of coal.

The President—There is no subject before the Association now. The motion was that the Association is to hear Professor Wurtz. The Association is now prepared to hear him.

New Processes in Proximate Gas-Analysis.

By Henry Wurtz, of New York.

Mr. President and Gentlemen:

Gas-Analysis, in the widest and highest sense of the expression—comprehending the proximate analysis of gaseous mixtures, natural and artificial, as well as the ultimate analysis of gaseous compounds—includes what have heretofore been unquestionably the most difficult and delicate, while also, when correctly viewed, the most fruitful and promising branches of laboratory chemistry. It is also quite just to assert of these branches that they have of late years been far too little cultivated by many chemists of the first rank. It is to this that I would attribute the fact that your own great and noble art of Artificial Illumination—to which I might add those of metallurgy and furnace operations generally—linger in a state of empiricism not in accordance with the actual advancement of chemical science. It may safely be alleged that we are now learning far more, and more rapidly, of the liquid and solid products of retorts and furnaces, than of the gaseous products. This should not continue; and I venture to hope that the observations I have to offer may in some measure lead the way, and to some extent lay the foundation, for the more diligent application of known chemical principles to the practical investigation of gaseous mixtures and products of chemical arts.

The class of methods known by the rather insignificant name of Eudiometry, had so great an impulse im-

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the illustrious Bunsen, that gas chemists have really seemed to me to merit since, in some measure, the reproaches cast upon the immediate disciples of Aristotle of old, who believed their great master had probed the depths of possible human wisdom; and, therefore, refused to interrogate Nature further. It is true that many of Bunsen's methods, apparatus, and manipulations in gas-analysis, will remain indispensable, and will stand as monuments to his fame—very little having been done since, except in the way of modification, by other chemists; but there are, nevertheless, cases and conditions often of great importance, where all so-called eudiometric methods fail to satisfy the practical requirements.

One such case may here be entered into as an example. This is the determination of *air*, as a contamination of illuminating gas. It is well understood that each single proportion per 100, of air, destroys at least 6 per cent. of the illuminating value of an ordinary coal gas. It is not easy then to exaggerate the importance of this case. But, in a eudiometer 500 millimeters long, one volume per 100 of air is but one millimeter of oxygen. A variation or error of observation of a single degree Fahr. of temperature, or of ·061 inch of barometer, down or up, will either double or destroy this determination. But by the methods I have now to propose, 1 cubic foot of such gas will yield, in a form amenable to the balance, 1·18 grain=076 gram of oxygen; and 2 cubic feet, ·3815 gram.

Moreover, in eudiometric oxymetry, the introduction of potassic pyrogallol into the gas under investigation, is always of necessity preceded by that of potassic liquor or potassic hydrate, to remove carbonic acid; and if this potash be washed out with water, say with a minimum, of 20 millimeters (in a eudiometer of 500 mm.), of the latter, this water will always abstract some of the oxygen sought to be determined. At 60° F. = 16° C., 20 mm. HO can take up (Bunsen) ·59 mm. of O; or, in

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this way, as much as 59 per cent. of the oxygen (and air) sought may be altogether lost! I may add that, in working on coal gas, the further possible, or at least supposable absorption, by this 20 mm. HO, of ·29 mm. of N, ·39 mm. of H, and ·48 mm. of CO gases—together with the ·59 mm. of O—1·75 mm. in all—might vitiate the CO^2 determination to the extent of 0·35 per cent. of the whole volume, in excess; which, in a coal gas purified by lime, would be a vitiation quite fatal to the value of the analysis.

Some eudiometrists may reply that they do not wash out the potash with water, before applying pyrogallol. If so, I must impugn their work on several other grounds—for instance, will the film of potash liquor on the inner walls of the eudiometer occupy the same volume as a film of pure water? My own experiments have shown me that it will not. Again, either solid potash or strong potash-liquor desiccates the gas, thus introducing another very appreciable error. A conscientious original investigator, who tests all methods rigidly himself, will devise ways to mitigate, if not to eliminate, some of these difficulties; but this does not meet the practical requirements of the case, for all are not competent to do this.

The above is cited as but one sample of the multitude of difficulties with which every really competent eudiometrist must admit himself to be environed.* Special and complex devices have not been wanting—many of them of great and permanent value—to lessen certain difficulties; but it has appeared to me that in

* I may be excused for here introducing the remark that I myself have endeavored to do my share with other gas chemists toward the emendation of Bunsen's system of eudiometry. My own efforts have been generally in the direction of simplification, and more especially to attain (what I have always deemed) the great desideratum of a reduction of the needful amount of quicksilver to a minimun. I now use simple devices and manipulations which enable me to accomplish all the essential work of eudiometry with, at the most, 10 lbs., and chiefly with not more than 5 lbs. of the liquid metal. These will soon be submitted to the chemical world.—H. W.

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those cases—including many of the most important ones, as, for example, illuminating gases, and gaseous furnace products—in which the mixture to be analyzed is attainable in volumes practically illimitable; it would be well to try to cut loose from methods which are purely volumetric, and to devise such new ones as would enable us to deal with quantities that can yield ponderable products; thus appealing direct to that infallible criterion, the chemist's "Court of last resort," the balance.

In this attempt, I have already met with success sufficient to encourage me to put forth the results before the chemical world, confident that some things will be recognized in them worthy at least of being followed up and brought to a further stage of perfection. This further pursuit of these paths of promise, will be my own task, so far as it may be permitted to me.

The methods I now put forth are founded on the general principle of submitting a slow current of the gas to be investigated to the action of a series of agents, so selected and combined as to absorb and separate, in succession, each by itself, the different proximate constituents of a gaseous mixture, converting each into a solid or a liquid form which can be weighed on a balance. About 1840, European chemists were using successfully methods of this class. One method, which arose at that time out of their experiments in this direction, was that still in use in "Organic Analysis," for separating in distinct and weighable forms water and carbonic acid. Strangely, however, the capabilities of these methods seem to have been looked upon as very narrow and special, and they have almost passed out of view. At the present day it is probable that a majority of chemists would not have anticipated, in advance, much satisfactory success in the application of these modes of procedure to such complex mixtures as crude coal gas, or a furnace gas. My experience has, nevertheless, tended to an opposite conclusion, and I believe that I discern,

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in this direction, the only practicable road to complete success in the proximate analysis of heterogeneous gases.

[In this memoir, I will here say, I must confine myself mainly to illuminating gases. The handling by these methods of furnace products will furnish subjects for future communications.]

In a crude coal gas, as drawn from the hydraulic main, over the retort benches, the following main constituents may be enumerated, which it is highly important that a gas chemist should be competent to separate and determine with precision :

1. Tar, suspended in the form of spray.
2. Water, in similar mechanical admixture.
3. Water, as vapor, dissolved in the gas.
4. Naphthaline (condensable).
5. Other condensable hydrocarbons.
6. Smoke and soot (with dust).
7. Ammonia.
8. Carbonic Acid.
9. Sulphuretted Hydrogen.
10. Carbonic Oxide.
11. Oxygen, that is, Intermixed Air.

Of these eleven proximate constituents, I have, so far, succeeded in separating, with very satisfactory sharpness, Nos. 1, 2, 3, 6, 7, 8, 9 and 11, eight in all, besides some approximation to No. 4, the naphthaline in excess. No. 10, the carbonic oxide, is still a subject of experiment.

My success, so far, is to be attributed mainly to the gradual attainment, by tentative experiment, of the following devices and manipulations.

First—Arresting suspended matter by means of empty dry flasks and straining through cotton previously *desiccated.*

Absorbing next, the ammonia, by means of reagents which acts on no other ingredient.

Next, drying the gas with CaCl, which, NH^3 being absent, may now be done.

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Next, taking up the sulphuretted hydrogen by a normal metalic salt, so selected or so managed as to give up no water or acid vapor to the desiccated gas.

Next, using sodic hydrate to absorb the CO^2, with certain precautions described below.

Next, alkalized pyrogallol or other suitable agent, to absorb oxygen, arranged so as to lose no water.

In the case of illuminating gases—with some few others—the final (rough) measurement of the gas is then made at an observed temperature by a gas meter; if with a dry meter, directly; if with a wet meter, after saturation with moisture at the temperature of melting ice.

In the latter case, of a wet meter, the amount of final moisture in the gas is determined by a reiterated desiccation with CaCl.

The whole process is finally completed and the separations rendered as sharp as may be, by a process of distillation, either at the ordinary or higher temperature, in a current of the same gas analyzed, that has been previously subjected to the same or similar treatment, and thus freed from all the ingredients to be separated from each other.

After final weighings, the *correct* initial volume of the gaseous mixture is calculated by certain formulæ derived, as specified below, from the crude meter indications and the final weighings.

I shall now proceed to an attempt to explain simultaneously, to save space, the details of the methods as applied to each constituent, and those of the construction, preparation and arrangement of the different pieces of apparatus, as connected and represented in the figures.

I. Analysis of Crude Gas, in the Gas-house, before Purification.

The mechanically suspended Tar and Water.—The joint devices for arresting these two substances, in the

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first instance, are shown in Fig. 1, letters A to F inclusive. A indicates an inch-thick soft-rubber cork, with two perforations, occupied respectively by a thermome-

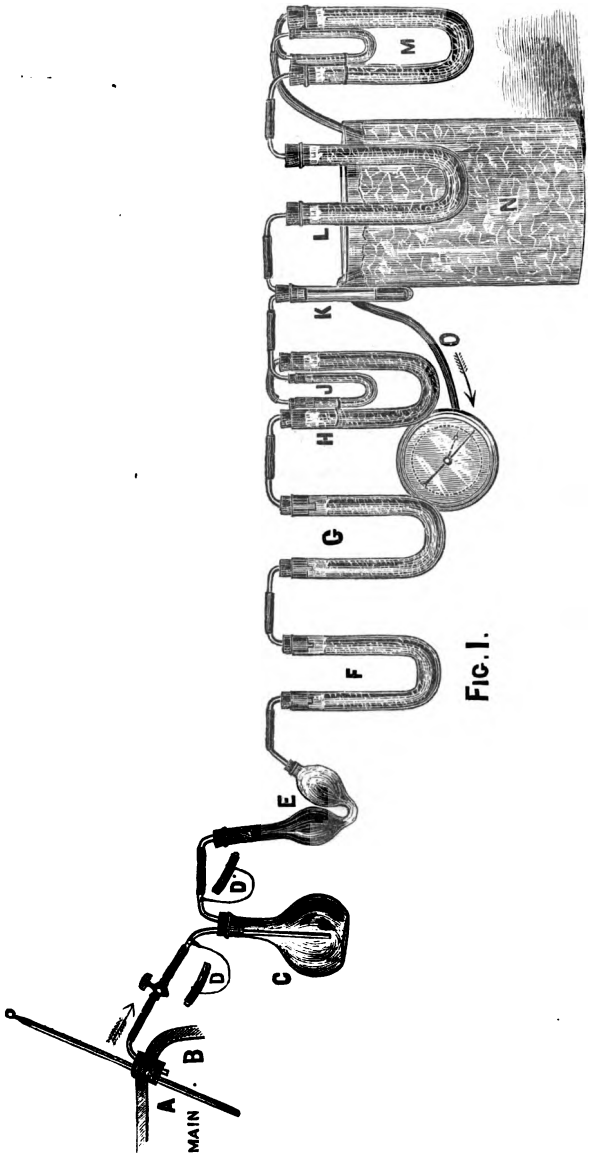

FIG. I.

TRAIN FOR THE ANALYSIS OF CRUDE GAS, FROM THE HYDRAULIC MAIN OF A GAS WORKS, ETC.

[NOTE.—Between G and H an additional tube, precisely similar to G, charged with *chloride of calcium*, is employed, which, for simplification has been omitted from the figure.]

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ter and an eduction-tube bent at a right angle, inserted into an aperture bored through the wall of the hydraulic main or of any other main in the works. This eduction tube must at once descend, to allow liquids to flow into the flask, and must have a stopcock in it. The first member of the train is an empty dry thin glass flask C, which collects almost the whole of the spray, aqueous and tarry. DD are two stoppers for closing C hermetically, constructed of pieces of rubber tube closed at one end by short sections of glass rod. The bent wires by which these are permanently attached to the flask had better be of iron than of copper, as they are to be weighed with the flask, and the latter metal is quickly blackened and may be slightly changed in weight by the sulphide of ammonium that pervades the atmosphere of the gas-house. In a permanent apparatus, for nicety, platinum wires had better be used. Copper wires, however, used here, and in other parts of the apparatus, may be protected pretty well by coating with collodion, or even with a film of paraffine. [All the brass stopcocks I use in these and all other operations with sulphuretted gases, I prefer to plate, inside and out with nickel; which protects them perfectly against sulphur. This nickel-plating, every gas chemist will find it well worth his while to perform for himself, as it is *very* easy to accomplish, in case of brass and copper surfaces, with slight practice. I propose publishing a note which I think will lead any laboratory worker to success in his first trials.]

These trains of apparatus are probably most conveniently set up by being suspended to a strong wire—best of soft copper—stretched tightly between two convenient points of attachment. To make this wire tense or "taut," it had better be in two pieces, attached first at the extremities then twisted together strongly and warily with pincers at the point of meeting. The tubes are hung on inverted V-shaped (Λ) wires bent into hooks below. These, for simplicity, are not figured. All the

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rubber tubing used as connectors, I wash laboriously, internally and externally, in a rapid current of water, with hard rubbing between the hands, until absolutely clean, then rub dry, and lubricate, within and without, with thick syrupy glycerine. The excess of this being wiped off, the tubing is found permanently more flexible, far less liable to abrasion of surface, more easily slipped over ends of glass tubing, and, above all, has its capacity for absorbing certain constituents of the gas reduced to a minimum. All the corks should be rubber, scoured and glycerated superficially in the same way. The cork at A—owing to the heat and actual contact with tar—and, to a less extent, the cork of flask C, are somewhat penetrated and softened, so that A gives out, after being used a number of times. The others last indefinitely.*

E and F are stuffed, uniformly, but as loosely as practicable, with cotton, which is best inserted and gently packed down, in successive small wads, picked out before insertion. The bulbous pattern, like E, † may present here some advantage, but it is not at all essential. Its use, as photographed in this case, was in order to bring down somewhat the level of the rest of the train. I have used, and prefer, a compound cotton apparatus, or two tubes of the size of F, united by a twisted wire in the manner of A in Fig. 4. These can be weighed together conveniently.

Even in case of a gas that has passed through condensers and scrubbers, it seems necessary to use two tubes of cotton. In one actual series of analyses, of unpurified coal gas before and after having passed the

* All these corks should be of the *best* quality made, Many in the American market are very poor—indeed useless for this kind of work. I procure mine from John N. Elmore (the successor of Quettier) at 193 Greenwich Street, New York; who will also supply, or have made, the different sizes and patterns of U tubes, etc.

† I may say here that E, as shown in the cuts, was in the condition left after having been used, and in drawing from the photograph, an attempt has been made, none too successfully, to reproduce the shading of the condensed soot.

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scrubbers and condensers, the second tube F, increased, on an average, in weight (all moisture having been removed) from the uncondensed gas ·128 grain, and from the condensed ·072 grain, per cubic foot of gas passed, up to seven cubic feet. The main consideration here is the initial *pressure* at command, of the gas. If the customary exhauster is employed in the gas works, and kept at work during the analyses, the pressure between the exhauster and the retorts may be found so low that a train attached between these, may not admit of more than one cotton tube, and even this packed as loosely as possible. At points beyond the exhauster, however, this trouble seldom occurs; it having been necessary indeed, in some such cases, with unpurified gas, to partially close the cock in the eduction tube, to bring down the rate of flow through the train to about one cubic foot per hour, which it should not in most cases exceed.

The Ammonia.—In order that we may employ, for dehydration, the highly convenient, powerful and reliable agent, chloride of calcium, it quickly became apparent to me, in my earliest experiments, that the ammonia must first be abstracted from the gas; and my first efforts were to decide upon the proper agents that could be used, in solid form, for this absorption. One of these I have so far sufficiently tested, by quantitative as well as qualitative experiments, to demonstrate its entire applicability to this use; namely, fused *potassic bisulphate.* It is proper for me here to state that the earliest preliminary experiments with the bisulphate, were made, at my suggestion, in the course of an investigation carried on jointly by Prof. B. Silliman,* Dr. S. D. Hayes and myself; in which we desired to absorb the

* Prof. Silliman has also since worked by himself on this or a closely-related subject, and made a communication to the National Academy, at the late Philadelphia meeting, to which I would refer. Prof. S., I believe, experimented chiefly on the utilization of crude commercial bisulphates, generally of soda, called "salt-cake" in commerce, for the technical extraction of ammonia from gas.

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ammonia of crude coal gas. We all became convinced, I believe, that potassic bisulphate had the power to take out *qualitatively* the NH^3 from gas; but the precautions essential to success, in a quantitative way, have been since worked out by myself alone.

The mode of preparation of the bisulphate is by simply cracking in a mortar to the average size of wheat grains, and removing the dust and finer particles by a sieve of eight holes to the inch. The dust is very painfully irritating and injurious, and its inhalation must be avoided, if possible.

[Though many chemists seem somehow to have acquired the idea that bisulphate of potash possesses more or less *deliquescence*, it in reality has none of this quality whatever, and it is not even hygroscopic, to any remarkable extent.]

It must not be supposed that the bisulphate takes up ammonia as NH^3, which would involve a very important error. The compound formed, as dessiccated for the final weighing, is the double sulphate of potash and oxide of ammonium. The factor *am* in the equations below must be obtained, from the increase of weight, by multiplying by a coefficient=·70833. And it may here be remarked that a part of another factor *wv* comes likewise from this increase of weight, through multiplying it by ·29267. This ammonia tube is lettered G.

The Water.—Chloride of Calcium for absorbing this, comes next in our Fig. 1 train, though, as it would be merely a duplicate of G, the CaCl tube has been omitted from the cut. I prefer—after trying many preparations—a *fused* chloride, assuring myself, above all, that it is free from every trace of causticity, and crack it up to the size of small peas, sifting out all that passes a sieve of six holes to the inch. For the small CaCl tube J, the one in M (Fig. 1), and J and L in Fig. 4, I find it desirable to crack but little, if any, smaller; to avoid risk of obstruction.

The Sulphuretted Hydrogen.—For this constituent I

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have tried several absorbents, but none as yet that answers, on the whole, so well as common crystallized blue vitriol, cracked and sieved to wheat-grain size. As in desiccated air it slowly loses some of its water (Graham found that in fine powder, over oil of vitriol, it lost in seven days 3 of its 5 water-equivalents), I add a small CaCl tube, which is of course weighed with it in all cases. The test tube K, containing a slip of lead-paper, belongs (qualitatively) with the cupric sulphate tube H.

With crude gas from highly sulphurous coals it may sometimes be prudent to duplicate this member of the train. Of course the small CaCl tube J need be added only to the second one. The increase of weight in this member is of course HS. If to be calculated as simple sulphur, as sometimes required, it must be multiplied by ·9471.

The Carbonic Acid.—The agent which combines, for this absorption, the greatest advantages by far, is that form of sodic hydrate now so common in commerce, cast into pencils, and labeled "soda by lime." In this class of operations the weight of CO^2 to be absorbed is often very large. In 10 cubic feet of crude coal gas containing 2 per cent. by volume of CO^2, there is about 172 grains by weight of the latter, which requires for absorption (if normal carbonate be formed) near 315 grains of sodic hydrate. Although some bicarbonate is usually formed, yet the absorbing surface required is large. Potassic hydrate, prescribed in the books, is wholly out of the question for these methods. The solubility of KO, CO^2 is so great, especially as much heat is always developed during the CO^2 absorption, that the water of the hydrate serves to melt the mass into a magma and quickly to obstruct the flow. In cases where mere abstraction of CO^2, without weighing, is the object, one large tube containing 10 or 12 ounces of sodic hydrate—as in H, Figs. 2 and 3—may be employed; but in the case under consideration, two tubes must be used, containing each 5 or 6 ounces, to reduce

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within conveniently weighable limits. These are here lettered L and M.

The soda pencils are cracked up, a few at a time, by gentle blows in a mortar, to lengths of from ·5 to ·7 inch. This is very rapidly and easily effected; but still a film of moisture is absorbed; and I have found that desiccated gas will then take up from it a trace of water. The precaution is therefore taken to append a small CaCl tube to the second of the two, M. This may be avoided if the Preparatory Train, Fig. 2, be employed to dry out these soda tubes, before their initial weighing.

The Meter and the Measurement thereby.—This most essential operation of all, is effected with every precaution to insure known conditions of the residual gas. In the case represented in Fig. 1, it is to be understood that a dry meter is used to measure the gas as absolutely freed from moisture, and at, or as close as possible to, the temperature of melting ice. Within N, filled with cracked ice, is coiled some feet of rubber tubing—well *glycerated* internally—and the meter is enclosed—leaving the dial exposed—in an outer casing, not here shown, filled with feathers, or better, with *ice*. In an emergency, muffling the meter in blankets may be resorted to.

The meters used must of course be most carefully tested and their average errors determined and taken note of. Space cannot, unfortunately, be here spared to explain the modes of effecting this. As it may often be necessary to use wet meters, like those usually found in photometric rooms, I have represented in Fig. 4 a modified mode of measurement, which admits of such use. Here also the whole meter, except the dial, ought to be protected, as before, from external warmth.

It will be readily understood that when the photometric meter—which usually registers but four feet in one revolution—must be employed, appropriate measures must be taken to mark, or to verify in some sure way, the number of revolutions; when these are desired, or

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are likely, to exceed two revolutions in all. In Fig. 1, as I ought further to explain here, the eduction tube O, which is the prolongation of the coil in N, passes to the inlet aperture of a dry meter, and not as in Fig. 2 below, to the rear of a wet meter drum.

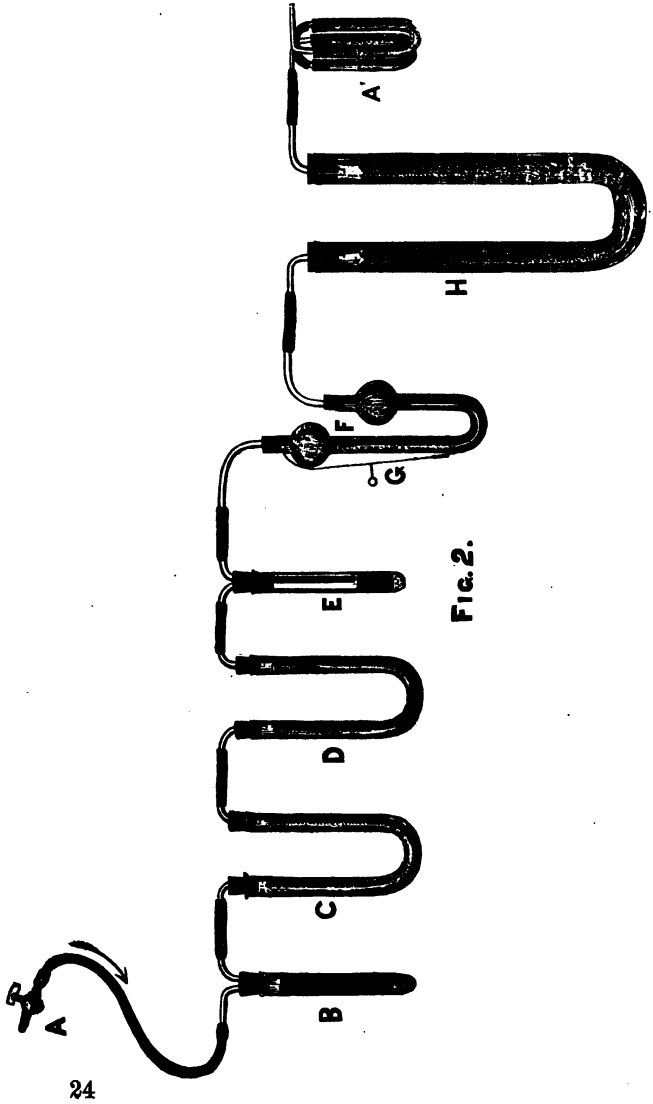

Fig. 2.

Supplementary or Preparatory Train; both for Preliminary Preparation of the Trains for Analysis, and for Completion of the Processes therein.

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II. Of the Preparatory Train. (Fig. 2.)

This is employed in the initial drying-out of the apparatus, preparatory to the first weighings; and also for the final completing of the separation, preparatory to the last weighings; in the latter case, by the distilling or transferring over, in a current of pure dry gas, of the liquids that condense, by mere refrigeration and adhesion, in the first tubes.

It is made up as follows: Stop cock A, in an induction tube from any service pipe bringing street gas; test tube B with inlet tube passing to its bottom, which contains a strip of turmeric paper, to indicate (qualitatively) ammonia; two U tubes, C and D, containing respectively granulated fused bisulphate of potash, and granulated blue vitriol; a second test tube E, containing slips of both turmeric and lead paper, to demonstrate the complete removal by D and E of the HS and NH^3 (the latter by comparison with the turmeric paper in B); a CaCl tube F; and a sodic hydrate tube H (of large dimensions, as shown, in cases where the street gas, through iron purification or otherwise, contains very much CO^2). [B, in this train, is not at all essential.]

In this figure the preparatory train is represented as attached to the first compound member (marked here A) of the train for analysis of purified gas, shown in Fig. 4. In Fig. 3, H represents the final member of the preparatory train; showing its connection with the train in Fig. 1, during the distillation preparatory to the final weighings.

It may be stated that this preparatory train being required only to furnish a current of gas free from moisture and impurities, it is obvious that the current that issues from one analytical train while in operation, is suitable for the preparation, for either initial or final weighings, of another analytical train; and that this circumstance will at times be available, and lead to saving of trouble in transportation and erection of apparatus.

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Another important point of practice with the preparatory train, demands a few words. Its union with the analytical train represented in Fig. 1, makes a long and very tortuous passage for the gas, which necessitates an important *pressure* to force a rate of flow sufficient for rapid work. This is very liable to cause difficulty, with street gas; particularly during the mid-day hours. It will therefore often be advisable to arrange so as to conduct preparatory operations during the night-hours. Cases occur in which special expedients may be necessary, to procure a sufficient flow. A small gas-holder, when available, may be used. The pressure in the mains between the exhauster and the purifiers, will always be ample to force one or even two cubic feet per hour, through almost any length of (unobstructed) train; but in this case it must be remembered that the preparatory train should possess an extra size and power, and be properly proportioned, to take out the large proportions of impurities present; for if a preparatory train left working with an analytical train overnight should become fouled, of course the whole apparatus would be liable to be rendered useless, and the whole time and labor be lost.

It may be scarce necessary to suggest that for these preparatory operations, coal gas is used only for convenience. With a holder, or an aspirator, a stream of *air* similarly freed from HO, NH^3, CO^2, etc., is generally equally applicable, and when the pressure has to be assisted, we may, in most cases, just as well use air, if we have the appliances.

III. Of the General Manipulations with Crude Coal Gas.

In addition to the details which have been given when describing singly the members of the train in Fig. 1, further explanations are needed, especially with regard to the application of the preparatory train thereto. In the preliminary preparation for the *initial* weighings, it is

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unnecessary, with the arrangement as here represented, to attach more than the first four pieces, to and including the bisulphate tube G: for reasons which will be obvious without explanation. Some five or six cubic feet of gas transmitted from a preparatory train, will dry out these first four members sufficiently to allow of correct weighing. This will be accomplished by setting and keeping the apparatus at work during one night, say from 5 P. M. till 8 A. M., or fifteen hours, at the rate of about 0·3 or 0·4 foot per hour. The rate of flow is readily regulated by a few observations, of ten minutes each, of a meter at the tail of any train. A little practice enables the rate to be judged of closely enough, by the size of the flame burning from a small straight glass tube at the tail of the apparatus, as shown in Fig. 4.

The preparation for the final weighings is here the important part, and indeed the only troublesome part of this analysis. Fig. 3 represents, as aforesaid, the mode of attaching the preparatory train to Fig. 1, for this final operation, or rather succession of operations. D here represents a new tube introduced at this time, which is an ordinary form of CaCl tube, but having its smallest extremity bent at an obtuse angle, as shown, and which contains, near its upper end, a slip of turmeric paper, and has, moreover, running through it from end to end, and projecting an inch at each end, a *small flexible copper wire:* the object of which latter is to clear a passage through the crystals of naphthaline which condense in this tube at a subsequent stage of operations.*

After this disposition of the apparatus has been made —D having been of course *weighed* with its appendages; and the jar of ice N (which is no longer of use) removed, the meter being connected directly with M—the first step is to distil over, at a very low temperature (unless saving time is important, at ordinary temperature) in the current of gas from the preparatory train—which

* This wire should have shown more distinctly in the cut, but this is only one of several unfortunate defects in these cuts.

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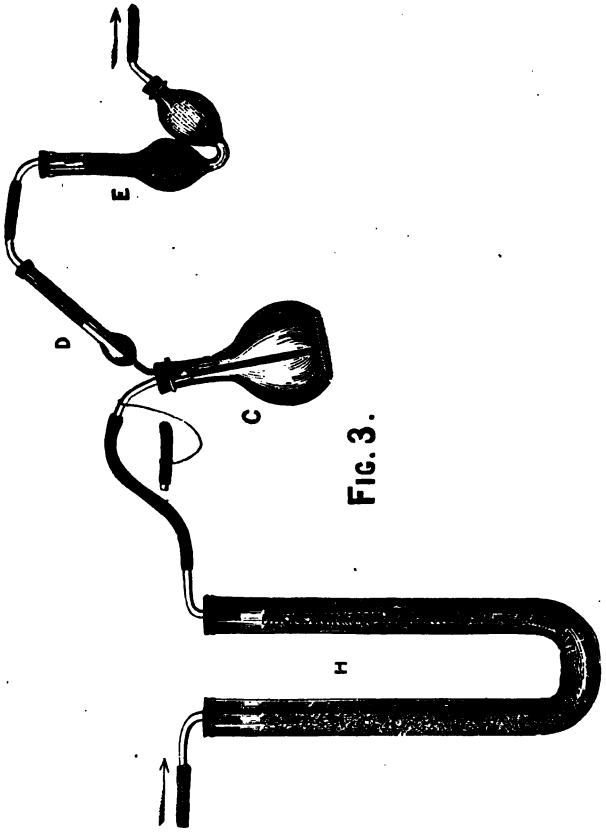

FIG. 3.

SUPPLEMENTARY ARRANGEMENT FOR COMPLETION OF PROCESS IN THE TRAIN SHOWN BY FIG. 1.

generally in this case may flow even as rapidly as two feet per hour—all the volatile ammonic carbonate and sulpho-hydrate that has condensed in the flask C and cotton tubes E and F. The volume of gas required to effect this may be double (or even more) that from which the liquid was condensed. It ought to have been stated that the total amount of crude gas analyzed by this apparatus should not exceed ten cubic feet. This volume is within the limits of manageability, but generally somewhat less is probably advisable. With a rapid current of gas, this complete transfer of the volatile ammonia compounds will be found to have been effected

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during fifteen or eighteen hours; but sometimes more time is required; and it is better to allow twenty-four hours for this part of the process. If an attempt to hasten it is made, by immersion of the flask in warm water, constant watching is necessary, as *naphthaline* then enters upon the scene, and may at once clog up all passage. The complete transfer of the ammonia is indicated by the return of the slip of turmeric paper to its natural color. As, in my experience so far, this liquid *always* contains *chloride of ammonium*, and possibly sulphite and other non volatile ammonia salts, those who wish to transfer *all* the ammonia to the bisulphate tube G, must introduce into the flask a weighed quantity of dry hydrate of soda.

When the ammonia transfer has been completed, the flask C is immersed—the gas-current being continued—in water sufficiently hot to volatilize the naphthaline, which will condense in crystalline form, together with water, in the tube D. The wire running through D now comes into play; and, in fact, without it, naphthaline would here become as great a cause of difficulty as it often does in the distribution of coal gas. When clogging occurs, the gas-current is stopped, the rubber connector between D and E detached, and the wire moved up and down or twisted round. With careful management, two hours' work and some two feet of gas from the preparatory train will suffice to transfer the naphthaline to D, which is then detached and weighed again. To remove the intermixed water from the naphthaline, the lower end of D is stopped, the cork and tube removed from the upper end, the wire coiled within, and this upper end connected by a wide short rubber connector with the open end of a test tube containing some granulated CaCl. When dry, the cork and tube restored, the stopper removed, and the weight again ascertained; the variation now from the first weight is the naphthaline, so far as it can be saved by

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this mode; which of course is imperfect, but is the best hat I have so far succeeded in devising.*

The flask C, still containing tar and water, is then removed likewise from the arrangement—the stoppers DD (Fig. 1.) being applied—and then H of the preparatory train is connected directly with the first cotton tube E; the gas-flow being resumed. Some five feet more of dry gas may be now required to transfer all the moisture to the CaCl tube between G and H (omitted from the cut). The water and tar in the flask C must be separated by careful distillation at a very moderate temperature, and in estimating the weight of the residual tar, account must be taken of the sodic hydrate that was added, as above, to eliminate the fixed ammonia.

The point at which the whole train becomes dry and ready for the final weighings, is readily perceived by a practised eye. One indication is a faint superficial whitening of some unaltered blue granules (if any) of cupric sulphate in the tube HJ. Several other indications might also be cited.

* Since the above was written, I have discovered that a very appreciable amount of naphthaline condenses, and remains throughout the final desiccation, in the cotton tubes E and F, and has therefore been rated as solid matter mechanically suspended—W.

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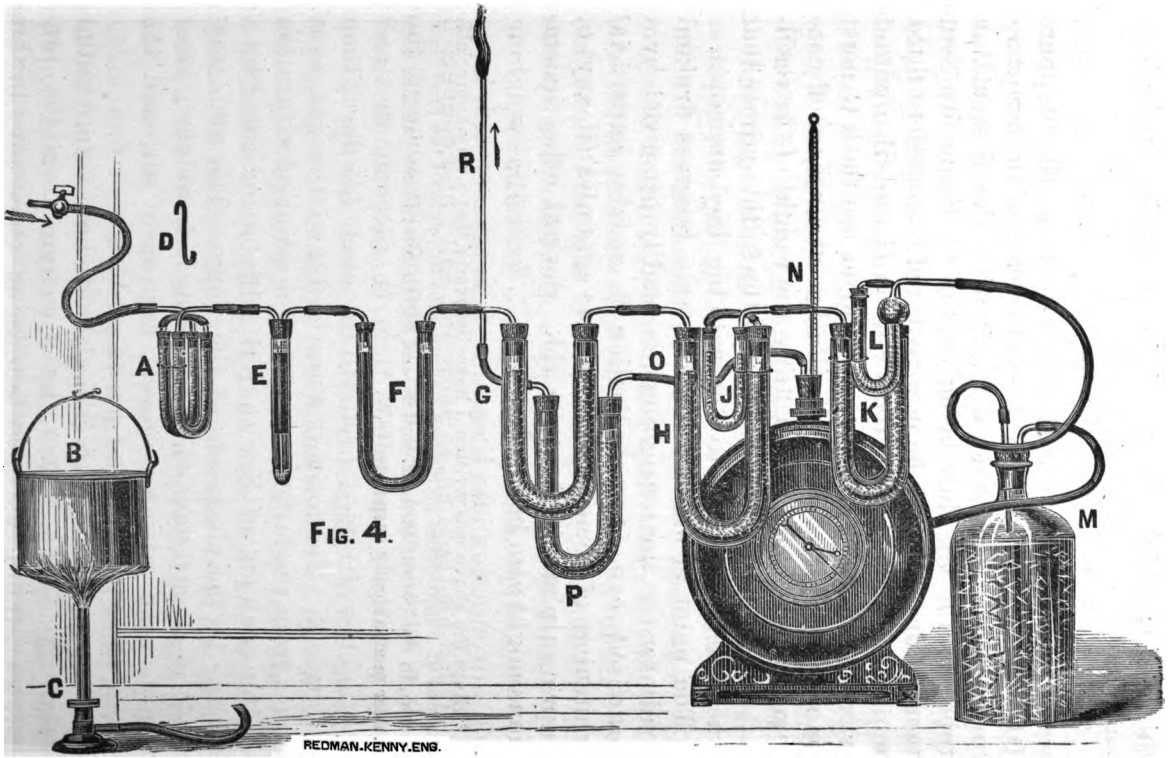

FIG. 4.

TRAIN FOR THE ANALYSIS OF PURIFIED COAL GAS, ETC.

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IV. Of the General Manipulations with Purified Coal Gas.

Fig. 4 represents a very complete train for this purpose. As the suspended matter here is absent or trifling in amount, and the ammonia usually very small, A represents a combined arrangement for taking up both these. The first or right hand U tube is loosely filled with cotton, the second one with granular bisulphate. E contains two slips, of turmeric and red litmus papers, to verify the perfect efficiency of the bisulphate. F contains granulated cupric-sulphate crystals. G is CaCl. H is sodic hydrate, with a small CaCl tube appended. The arrangement KL, for determining oxygen, requires special explanation. K contains glass beads or broken-up glass rod, wet with a concentrated solution of pyrogallol in previously boiled water. L contains CaCl. As, in order that the pyrogallol should take up the oxygen, there must be an alkali present, the following special course is adopted for preparing KL for initial weighing and introduction into the train. K is immersed, L being detached for the time, in snow and salt; and connected with a flask like C in Fig. 1, containing some of the strongest liquid ammonia. A current of common street gas is then directed first into the ammonia flask, then through K. The former is warmed, and the gas, as it issues from the latter, lighted. The point of saturation of the contents of K with NH^3 will be indicated by a change in the character of the flame. The ammonia-flask is then detached, L replaced, K L weighed after applying stoppers to prevent ingress of air, and the whole attached to J and put in position.

A, in connection with E, is also dried out before initial weighing of the former, by a current from the preparatory train; this operation being accelerated in this case, by immersion of A in the boiling water in B, which is raised up and hung, for this purpose, on the little wire pothook D. It is to be observed that the two tubes

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in A are weighed separately and not together; and to avoid hygroscopic moisture, cooled and enclosed, while weighing, in close boxes of sheet brass or tin. The members of this train G, H, and P require no preparatory desiccation before weighing.

With reference to tube F, a special remark should be made. The *hygrometric* equilibria of the cupric sulphate in the aerial and gaseous media respectively, may appreciably vary; even at the same temperature. A safe plan, therefore, before initial weighing of this tube, will be to pass through it a current of the gas to be analyzed, for a few minutes. This will also serve as a useful qualitative test, in advance, of the amount of HS present.

When the HS is very minute, as it should be in a well-purified street gas, there is another method available, which I have often used, and which may be preferred, as surer. I find if the granulated blue vitriol be spread out in a gentle sand-bath heat, for some days, it loses most of its water, turning white and chalk-like, without falling to powder, and will now still absorb HS readily, even though the latter be absolutely dry. If F be charged with such dehydrated cupric sulphate, it may be introduced after the CaCl tube G, instead of before, and will then absorb from the gas only HS. If it has lost three-fifths of its water, it will not impart any moisture to the gas at ordinary temperatures. (See *ante*, Graham's experiments.)

If, however, the gas is strongly sulphuretted, this plan will not do; as sufficient *sulphuric anhydride* is then set free to act appreciably on the hydrocarbons present, both by absorbing them, and by forming SO^2.

After the whole train is put in action, during the actual analysis, should it be practicable to *watch* the apparatus during this stage, A may be *kept* immersed in the hot water in B, which will save subsequent expenditure of time in preparation for the final weighing. K must be watched from the first, and if it turns brown very rap-

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idly—indicating *much* oxygen present—the current must be stopped when the meter has shown about one foot flow, and KL taken out to be weighed; resuming—after recording the meter—with a direct connection from J to M. This, because it may not be safe to trust K for more than one foot of a gas *largely* contaminated with air.

In the absence of an adequate number of *arrows* in this cut, a little examination will, I trust, make clear the course of the gas from M to the inlet of the meter at its axis in the rear, and out again, through the rubber tube O, to the final CaCl tube P, and thence through the vertical glass tube R; at its exit from which it may be kindled.

The usual rate of flow advisable, if attainable, with this train, is about one foot per hour; and the whole amount of gas analyzed should not be ordinarily more than ten cubic feet. This does not necessarily apply to the NH^3 and HS determinations, however; as in a well-purified street gas the amount of these in ten feet only might be scarcely appreciable. Therefore, after some ten feet has passed the meter, the latter having been read and recorded, direct connection should be established from F to M, the intervening members being thrown out. The flow may then be kept on through A, E, F, M, the meter, and P, even up to 50 or 100 feet; or until the registered volume is judged sufficient for these two constituents.

In these latter cases, it is obvious that the common one-dial photometer-meter, as in the figure, will not answer; and it will be necessary to provide a meter having dials enough to register continuously up to 100 feet, as well as down to decimals of a foot.

In the operation with purified, unlike that with crude gas, no general distilling or transferring process is required before the final weighings. It is only essential that A should be free from condensed moisture at the close, by reason of immersion in B; or that it should be sub-

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sequently freed therefrom, by means of a dry gas current through and from the preparatory train.

V. Of the Dimensions of the Apparatus, etc.

The sizes and weights of the different pieces of apparatus must not be left unexplained.

Flask C is of one pint capacity. It is convenient to have at least four different sizes or patterns of U tubes. The largest, represented by H in the preparatory train, is about 13 inches high, 1·1 inch internal calibre and 2·25 inches between the limbs. The second size is the most useful size, the corresponding dimensions being about 8 x ·9 x 2 inches, and is exemplified in Fig. 1, by F, G, H, L, M and the omitted CaCl tube; and in Fig. 4, by G, H, K and P. The third size, C and D in Fig. 2 and F in Fig. 4, may be 6·5 x ·6 x 1·9; and the smallest, represented in duplicate in A, and by J and L in Fig. 4, also by J and in M in Fig. 1, is about 4 x ·4 x ·75.

The relative proportions of different members of a train to each other are worthy of careful consideration, in planning an investigation; and much time and labor may often be thus saved. These proportions will differ with the conditions and with the nature of the gas, very largely.

For convenience in weighing, wires may be attached, as has been shown in the cuts in one case only—the CaCl tube GF in Fig. 2. As before stated, these wires, unless of platinum, are objectionable in the atmosphere of a gas works; and the tubes can just as well be simply laid across the pan of the balance. The balance should be capable of bearing safely a load of at least 300 grams or a little more, and indicating one milligram; that is of turning perceptibly with the 300,000th of its load.

One of the worst obstacles to accuracy in weighing large glass apparatus delicately, being the well-known attraction of glass for moisture, I have adopted, as

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hinted before, a very valuable device; simply to provide thin polished brass, or tin cases, closing tightly, but *not hermetically*, suited in size to different sizes of tubes; within which the latter are shut up while warm and dry.

VI. Of the Calculation of the Results.

To obtain from the observed volume, as per meter, the true initial volume of the mixed gas and spray operated on, requires some calculation. Taking first the most complex case, that of a crude coal gas from the hydraulic main, we shall have the following

FACTORS.

The observed volume, in cubic feet and decimals;	which call *v*.	
The final Fahr. temperature of the gas;	which call *t*°.	DENSITIES.*
The weight of liquid tar, in grains;	which call L*t*.....(Water—1)—	1·25
The weight of liquid water in grains;	which call L*w*.	
" " initial watery vapor:	which call *wv*†.....(Air—1)—	0·6220
" " " gaseous ammonia (NH^3)	which call *am* ..... " " —	0·5896
" " " " sulphuretted hydrogen;	which call *s*..... " " —	1·1749
" " " " carbonic acid	which call *c*..... " " —	1·5202
" " " naphthaline vapor	which call *n*..... " " —	4·5700

Other constants required in our calculation are:

1. The coefficient of dilatation of coal gas for the Fahrenheit degree. I adopt $\frac{1}{491{\cdot}9}$

* The densities adopted for NH^3, HS and CO^2 are the theoretical ones, employed by Bunsen in his Gasometry. Other authorities differ perceptibly about all these. The density of aqueous vapor adopted is very close to Regnault's figure. Bunsen used ·62205.

† It must not be forgotten that an addendum to *wv* is derivable from the final weighing of the bisulphate of potash tube.

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2. The number of grains of pure water in a cubic foot, at 60°Fahr., which I make 436320.

3. The number of grains of dry air in a cubic foot, at 32° Fahr.; equal 565, according to Regnault.

As to the first, Ph. Jolly has recently given (*Chemisches Centralblatt* for 1874, p. 241; from Poggendorf's *Annalen*) new determinations, which, for Fahr. degree are

for H gas,	·002031
" CO^2 "	·002059
" Air "	·002039*

As coal gas is almost half hydrogen, I have adopted ·002033, which equals :—$\frac{1}{491{\cdot}9}$

For calculating the third constant, I have adopted as a basis a figure kindly calculated for me by Prof'r A. M. Mayer†, directly from the original determination of Regnault, for a litre of dry air under normal tensions, equal 1·29278 gram. Cooke's Chemical Philosophy gives this figure equal 1·29319 gram.

From Mayer's figure I get, closely enough, for one cubic foot air, at 32° Fahr., 565 grains. In the most complex case of all, as in Fig. 4, when a wet meter is used, and the gas measured with a certain content of aqueous vapor, afterwards determined by means of the CaCl tube P; we have, in this weight, still another factor, wv'.

The following crude expression may now be first jotted down; V being the corrected initial volume sought, in cubic feet, at 60° Fahr.

* The figure of Regnault for this constant for air is almost the same as this; that of Magnus is a trifle lower. For Fahr. degree—

Regnault ·0020389, or $\frac{1}{490{\cdot}46}$

Magnus ·0020377, or $\frac{1}{490{\cdot}75}$

†Prof. Mayer remarks that he found a slight error in Regnault's own reduction of his observations.

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$$(A.)\quad V = v + \frac{60 - t^\circ}{491\cdot9}v + \frac{Lt}{436320 \times \text{dens}Lt} + \frac{Lw}{436320} + \frac{wv}{565 - \frac{(60 - t^\circ)\,565\ \text{dens}\ wv}{491\cdot9}} - \frac{wv'}{565 - \frac{(60 - t^\circ)\,565\ \text{dens}\ wv'}{491\cdot9}}$$
$$+ \frac{1}{\frac{(491\cdot9 - 60 + t^\circ)\,565}{491\cdot9}}\left(\frac{am}{\text{dens. } am} + \frac{s}{\text{dens } s} + \frac{c}{\text{dens. } c} + \frac{n}{\text{dens. } n}\right);$$

which on interpolating the density figures above, may be reduced to—

$$(B.)\quad V = 1\cdot12198v - \cdot002033t^\circ v + \cdot000002292\left(\frac{Lt}{1\cdot25} + Lw\right) + \frac{wv - wv'}{522\cdot134 + \cdot71443t^\circ}$$
$$+ 491\cdot9\left(\frac{am}{143876\cdot256 + 333\cdot124t^\circ} + \frac{s}{286703\cdot2 + 663\cdot82t^\circ} + \frac{c}{370964\cdot525 + 858\cdot9t^\circ} + \frac{n}{1115187\cdot4 + 2582\cdot05t^\circ}\right).$$

In the case in which t° equals 28° F., as when the final temperature is reduced quite down to that of melting ice, we may express it thus:

$$(C.)\quad V = 1\cdot065065v + \cdot000002292\left(\frac{Lt}{1\cdot25} + Lw\right) + \frac{wv - wv'}{542\cdot14} + \frac{am}{311\cdot45} + \frac{s}{620\cdot65} + \frac{c}{803\cdot06} + \frac{n}{2414\cdot1}$$

In the case of purified illuminating gas, as from street mains, in which the suspended tar and spray should be, and ordinarily are inappreciable, the second right-hand member of the equation (C) disappears, as also the last factor representing the condensable naphthaline; and if, in addition, the gas has been measured dry, by means of a dry meter at the tail of the train, so as to eliminate wv', and also at 32° F., we have (omitting also an inappreciable fraction in the first factor) the simplest case of all:

$$(D.)\quad V = 1\cdot0651v + \frac{wv}{542\cdot14} + \frac{am}{311\cdot45} + \frac{s}{620\cdot65} + \frac{c}{803\cdot06}.$$

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The correction for *Atmospheric Pressure* has not been introduced into the above, and is independent thereof. In exact work, the barometer must of course be observed at short regular intervals, and V should be further corrected by reduction to the standard pressure of 30 inches or 762 mm. This is very simple. Calling the volume as thus corrected V'; and the mean of the barometric observations P. Then—

$$V : V' :: 30 \text{ inches} : P;$$

the volumes being inversely as the pressures; and—

$$V' = \frac{P}{30} V;$$

from whence an easily remembered rule. Multiply the whole of the right hand side of the above equations by (E.)— (·03333+)P.

Equation (D.) may then—with this further correction for atmospheric pressure P—be reduced to the following:

(F.)—

$$V' = \cdot 0355\ Pv + \cdot 033333\ P\left(\frac{wv}{542 \cdot 14} + \frac{am}{311 \cdot 45} + \frac{s}{620 \cdot 65} + \frac{c}{803 \cdot 06}\right).$$

To the above discussion, it seems proper to append the remark, that the data determined by it, while necessary to the gas chemist, are not indispensably needed by the mere practical expert; who may be more concerned to refer the proportions of the constituents, as found, merely to the volume of *purified* gas, brought to, or near to, normal conditions of tension and moisture. This is a simpler affair. For the bottle of broken ice in the above train, Fig. 4, I substitute, in this case, a similar one filled with *clippings of clean sponge saturated with water*, to serve the double purpose of bringing the gaseous current both to the temperature of the air, and to the maximum content of aqueous vapor correspondent thereto. If this be accurately enough accomplished, the direct reading of the meter, whether the latter be wet or

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dry, will be the required volume subject only to the barometric correction above specified. The final CaCl tube is then not needed, though it might still be used as a check upon the process, and will give a general and *precise* datum from which the gas may be calculated to any standard of temperature and moistness.

Mr. White—I move a vote of thanks be tendered to Professor Wurtz for his extremely interesting lecture, and the experiments which he has presented to the Association this morning. Carried.

The President then addressed Professor Wurtz, conveying to him the thanks of the AMERICAN GAS-LIGHT ASSOCIATION.

It was moved that the subject which was laid upon the table be resumed. Carried.

Mr. White—There is a paper to be read upon the subject of Purification. I think it would be better to have that read.

The President—The Association has decided to take up the other matter.

Mr. Cathels—I simply want to ask a question of the Citizens Company, if I understood it correctly, that five men were engaged in the manufacture of 300,000 feet of gas, or ten men, five in the day and five at night?

Mr. Libby replied by saying it was four men.

Mr. White—As my paper seems to have been the source whence all this discussion has sprung, I would like to call the attention of the Association to some remarks made in that paper. I spoke in the opening of the paper, of the fact that I knew I should be traveling upon a dangerous and much disputed ground, in entering at all upon the discussion of the subject. I further say in the paper, that we have no desire to proselyte any company in the country. I was simply relating in that paper the result of the experiments made at our works, and the general benefit we had derived therefrom. There are some points, however, which have been raised, and some questions asked here this morning, which I feel

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it is due to myself and the Association to reply to. I did not, as I stated in my paper, give you actual figures of the results at our works. I did not, for two reasons—one that they might be brought out in discussion, and another that it would be almost impossible for me, within the limits of that paper, and of your patience, to go into any extended and tabulated defense of the subject of the paper. I made the bare assertion in that paper, that my company were manufacturing gas cheaper and better than they ever made it under the old working. I claim that we put the gas into the holders, as I said, at about one-third less cost than under the old process, in round numbers; probably it will not be within a cent or two of exactly one-third, but it is in that neighborhood. The absolute figures are withheld, for the simple reason that I did not wish to make the fact a public one. Among ourselves I am willing to give any facts to be used, to convince the gentlemen actually interested in this matter, any facts that are necessary for such information. We would cordially extend to them, upon a visit to our works, or here in discussion among ourselves. The point that Mr. Littlehales makes is a good one, upon the question of labor and the general saving, and it is one that I feel perfectly at liberty to reply to. It seems to me, if I can come here upon my authority as engineer of my company, and upon my known reputation among you, as I think, as a gentleman of probity, and assert that our pay roll, an indisputable thing, demonstrates the fact that we have reduced the labor in our works fully one-half—if I say to you, gentlemen, that instead of running 20 or 25 or 30 benches of five retorts each we made all the gas we wanted, in the press of last winter, with ten benches of four retorts, and two benches of naphtha and two of water gas, making altogether fourteen benches, our daily consumption being that winter in the neighborhood of 1,000,000 feet of gas. Last winter it was a little less than 800,000, but the gas was all made from fourteen benches. It is not necessary

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for me to say to those practically engaged in gas making, how many men it takes to run fourteen benches. You know that as well as I do. In making the assertion that we make gas for 80 cents a thousand feet, and put it in the holder, I know that strikes a great many gentlemen as not a remarkable exhibit; but the gentlemen must take into consideration the fact under which we work—that in the large cities where labor is high, we cannot compete with you who are differently situated on the question of labor; but take your own price of coal—take the cost of naphtha—reduce your labor one half—reduce the quantity of coal you use half or nearly so, and then see where you will reach in your figures. I cannot, of course, stand here to-day and say we make gas for such and such a price, and have a gentleman rise up and say we can do so and so in our country without the naphtha gas. That gentleman is talking of labor that may only cost him $2.25 a day, and coal that may cost him $4.50 in his retort house. The remarks I made last night were based upon the past year's business, when labor cost $3.50 and coal cost $8.25, and I am now speaking of a past and closed year's work.

If this thing is fallacious, I certainly desire its fallacy pointed out. If I can deceive a body of stockholders composed of prominent business men, and a board of directors, than whom no shrewder business men are engaged in our profession, and if I can deceive my much respected and very able president, I am a sadly underrated man outside. If I have gone on in my works for twenty months, and studiously and successfully deceived my people, and yet paid them larger dividends than they ever got before, I think I am a very successful and underpaid gas engineer. Money is the test of this thing. We have gone on, month after month, in this business. We have lessened our expenses of working—have paid our regular dividends, paid our current indebtedness, and owe no man anything. Could this be done in working a non-paying concern? I venture to

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think not; the money must be earned before it can be expended or divided. Touching upon some points of Mr. Littlehales, as to why I do not describe fully the method we employ in manufacturing, I beg to call his attention to my description in my paper of this very matter; I cannot be more explicit, so will not now try. As to the fact that failure has followed failure, and scheme followed scheme to a common result it is neither here nor there. I admitted that all this was true—that men had crossed and re-crossed this ground until it was a confusion worse confounded of patented failures; but claim that the richest fruits of invention and thought, like those of nature, come from ground vivified by the very process of decay. Again, I was unable to say why the other companies of Brooklyn and New York do not follow us into this new field any more than I can account for some of Mr. Littlehale's own views. This I do know truly, it is a knowledge we all show, that men will differ upon facts as well as upon theories, no ten men seeming to see a thing alike from any one point. When gentlemen will prove that gas-lighting is a failure, because Sir Humphrey Davy said it was impossible to light London, and that the railroad is not superior to the canal boat for rapid transit, because many good and thoughtful people once believed otherwise; or explain why all changes meet just this species of attack in their outset, I may be sufficiently enlightened to tell why other companies do not join this movement; but I can cipher up their loss in waiting for some other to ford the stream.

I did not claim, nor do I claim, that these workings are perfect, or that we had reached the limits of this investigation. I was very glad to meet Mr. Edgerton this morning and hear him say what he did. I feel with him, that we have just entered into a field, in which I frankly believe the next great change in our process of manufacture will occur. It does seem to me, that without giving the gentlemen engaged in our business the absolute detail of fact here, these asser-

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tions, for they cannot be disputed, ought in a measure to suffice. If it is necessary, I have the exact details of every portion of our manufacture and can give them. There is no intention of deceiving you; there is no desire on my part to lead you into this thing. I should not gain one penny if every gentleman in the room purchased the right to manufacture. It is of no value to me; but as a member of the Association, and on your invitation, I have written a paper on the subject, and I have done it in that spirit of frankness in which I expect to be met by you all, and in which I expect to be dealt with here. If, in closing, I have neglected to meet all the questions asked, it has been from no desire to screen myself, as has been charged, behind glittering generalities. I made no notes of the argument of others, so will answer any further questions, if the desire still exists or your patience lasts.

Mr. Littlehales—I would like to make one remark more. It seems that Captain White has still avoided one of the main points. He says that he is making gas one-third cheaper than it was made by his company before. I would not question him for a single moment. The chances are that before it was badly managed; there was waste—but that does not touch the question of oil *versus* coal. He says he has made larger profits for the company, and that should be judged as one of the tests in favor of the naphtha process. To my mind it is a perfect farce. I may say that I am in exactly the same position, in reference to that, as Captain White. We are making gas cheaper; we are producing more; we are working with less retorts; and we are making more profits—that point therefore, falls to the ground altogether. It does not touch the question. We want to know the value of oil *versus* coal, yet we do not know it. He says they are making it cheaper now than they used to; that is no point, because there may have been a great deal of mismanagement, and lots of things we

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do not know anything about—because he is now making it cheaper than before, does not touch the question.

Captain White—I will say, in reply, that there is only one way for us to get at that. I know what the works in the city are producing per ton of coal; that is the only way possible for me to get at it. The works in the city of Brooklyn are managed by other gentlemen beside myself. There are six of us here. I think four out of six are engaged in the manufacture of coal gas. They are four gentlemen second to none in our profession for ability. Now, I will take the results of their works, the yield per ton, the standard illuminating power, and cost of manufacture generally. I take that as a basis and make an estimate upon it; and I assert that my claim still holds that I make gas cheaper than they do. I do say that the Citizens Gas Company and the Peoples Gas Company, making gas with the use of naphtha, do make and put in their holders a standard illuminating gas cheaper than other companies in the city are able to do. I say my friend, Captain Benson, makes 10,400 feet of gas from a ton of coal. I know what it costs him, for I buy the same kind of coal. We make an estimate upon that. I know just as well as Captain Benson does how many men it takes to handle his works. I can judge fairly of all the material used, and of the rebate from the sale of residuals, so an estimate made up in that way gives us the cost of coal gas in the holders. Now, I will make the same quantity of gas of, say, same illuminating power, or better, nearly one-third cheaper. My directors have called upon me to make estimates touching upon this very question, and the only way I can get at it, is to say we make 600,000 feet of gas in a day; and making it in the old way, we can only say it will take so many tons of coal, so many retorts, so much purification, and labor proportioned to these large operations. Write these figures down, and say it costs you to put your gas in the holders one dollar, all credits allowed, and you cannot make

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it any less here. Now make the gas the way I do, and you use less coal and less labor, you use less purifying material, and have everything in your favor in point of wear and tear and repairs. As one-half or one-third of your gas is made from naphtha, which costs 4½ cents per gallon, and a gallon will make 90 cubic feet of 60 candle gas; we make about 130 odd feet to the gallon; but, of course, that includes the diluent, of water gas.

Mr. Neal—I have three questions I would like to ask. In the first place, what is the specific gravity of your gas, the weight of it as comparative with ours. Second, if it is, as I understood, much heavier than our ordinary coal gas, are your consumers obliged to change their burners with large apertures? Third—has the consumption of a given number of consumers fallen off, by reason of this change, giving them a heavier gas? I am told that it has, that their bills are not so large, and therefore there is not so much money coming into the treasury from a given number of consumers.

Captain White—Those are questions that I am perfectly willing to answer. The gravity of our gas is certainly nearly ·130 heavier than coal gas of a similar illuminating power. Our gas averages between 525 and 600. That this does have an effect upon the consumption, there is no question. We estimate in our district there is about two to three per cent. loss in our con sumption. The consumers through our district have, to a large extent, changed their burners; that was done a year ago, when we first commenced our experiments, and used the wrong process, when the gas was very heavy and contained a large amount of air. I do not use in my own house burners of any larger openings than for ordinary coal gas. The results shown in our district now—and it is a bad season for us, the business houses are suspended from the dullness of the times—but our district shows a steady gain right along in the consumption, as compared with the same months of the past year. So that, while we do lose a certain per cent., we

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are still gaining something right along. The loss is small and is to be considered as part of the cost. I have not been urging at all upon you the use of the naphtha gas alone. Gentlemen have said here that in using nahptha gas they lost the sale of residuums—that does not follow as we work.

Mr. Neal—I did not refer to the falling off of consumption; but, supposing to-day you send out the ordinary coal gas you used to make, and a consumer burns one thousand feet to-day, to-morrow you send out the gas you are now making—will that consumer burn the same amount in a given time? That is the point.

Mr. White—I was endeavoring to answer that. I do not think he will burn within two or three per cent. as much as he did, and I consider that as part of the cost of the gas. If instead of selling a man 100 feet, you sell him 95, this 5 feet ought to be counted out of the cost.

Mr. Sutton—Will your 16 or 17 candle gas be any different from the 17 candle gas of the Manhattan Company in New York?

Captain White—No, sir; I do not think it will. It will take the same burner; a 16 candle gas depends upon its containing certain constituents, in certain proportions; and it don't make any difference whether you put them in one way or another. I think that I have very fully occupied your attention, and it would be well if I gave way and let Mr. Hyde read his paper on purification.

Mr. Littlehales moved that the committee be especially requested to investigate, and report to the Association, upon the following points, in reference to the nahptha gas process, which was seconded by Mr. Cathels:

1st. The cost per 1,000, for material.
2d. " " " labor.
3d. " " " purification.
4th. " " " wear and tear of retorts.
5th. The cost per 1,000, for gas at consumers, meters, calculated on gas paid for.

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6th. The rates of wages.

7th. Amount of capital required per million feet annual make, to construct works for naphtha, as compared to that for coal.

Motion carried.

Mr. Edgerton—I have a few remarks to make. There cannot be, of course, any detailed statement made here, of the cost of naphtha gas, or of the mixture of the naphtha gas with other gases, at the price of labor and materials in all other localities. That is out of the question. Every individual has to investigate that with a view of knowing the prices in his locality. Now, I make this statement by which you can make such a calculation for yourself; if you visit the works and see whether the gas is successful, you can inquire the price of the materials, and you can apply those prices there to the prices as you find them at home. I state this again, that the equivalent in the city of New York, where one gallon of naphtha costs at present 2½ cents., made into a commercial naphtha gas, and distributed; the commercial equivalent, in coal gas of 15 to 16 candle power, is 400 cubic feet. In regard to the labor that it requires to make the naphtha gas, you have already had sufficient statements from Captain White, which show the amount that can be made per day. There is the foundation of the thing. You require one gallon of naphtha to make a commercial equivalent, in lighting power, of 400 cubic feet of coal gas. If anybody has made any experiment with naphtha gas that differs from this, I challenge the comparison. That, I say, is what I know upon this point. And I also further say, that four years ago, when this question came up, I applied to all the scientific ability in the country in regard to it; I applied, among others, to Professor Wurtz, and in his report is contained the statement of William Farmer, of results of experiments made at the Manhattan Gas-Light Company, and this agrees materially, within a small percentage, with the

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statement I now make. I have the original of that report of Professor Wurtz, and it is a report of facts that cannot be gainsayed. In applying and trying to find out the price of gas in your various localities, you want simply the fundamental data—that is, the quantity of gas made from a certain amount of material, the illuminating power of that gas, and the labor required to make it. The prices you have to apply in your own localities, at which you obtain the material. The prices made on the Brooklyn gas would not answer elsewhere.

Mr. Harrison—There seems to be a difference of statements as to the equivalent of coal and naphtha gas, which is worthy of a little more attention. Mr. Edgerton states that the equivalent of one gallon of naphtha gas is 400 feet of coal gas. Captain White stated that he makes, from a gallon of naphtha, 90 ft. of gas, which, diluted down to the quality of 16 or 17 candle gas, is 130 to 140 feet. Mr. Libby, the president of the gas company, states it about 130 feet. The difference between 130 feet, which is the equivalent obtained by the Citizens Gas Company from a gallon of naphtha, and 400 feet, which I understand Mr. Edgerton to state, is worthy the consideration and the attention of the Association.

Mr. Edgerton—That point is well worthy of our attention, and I propose to explain that point. I propose to show that the difference between these results is very easily explained, for this reason. That I stated the commercial equivalent of naphtha gas, made from a gallon of naphtha, made properly in my opinion from the actual test of that gas, burned in suitable burners, without any admixture of anything whatever—that is, naphtha gas. Now, Captain White's equivalent is based upon the mixture of other gases. As to those other gases I have not understood their quantities, percentages, or illuminating powers. If I understood these, I might give as I have made in other cases, an estimate of the reduction of candle power, due to mixture with the various

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diluents, air, hydrogen, carbonic oxide and various other gases. But the very moment you commence to introduce into the 400 cubic feet of naphtha gas, the equivalent of 400 feet of coal gas, and made from naphtha—the moment any diluent is introduced, whether air or carbonic oxide, there is a change in the lighting power of that gas; of course you cannot get the same amount of light out of it. The estimated reduction can only be ascertained by experiment. If Captain White gets from a gallon 130 cubic feet of combined gas, and that 130 cubic feet of combined gas gives an illuminating power of 17 candles, then the combination has been at the expense of the petroleum gas, to the extent of fifty per cent. of the material. That seems clear and fair. Now this of course must be made the subject of a strict and careful investigation by the committee, and cannot be gone into detail here, but it is for them to work out, and to see how it is done. They will have no trouble, except to go to places where it is done, or ask the people who do it how it is done.

Mr. Littlehales—Are the results of Mr. Edgerton literal results? Are they the results of actual work?

Mr. Edgerton—They are derived from the results of twenty-two gas companies, the practical running by the burning and consumption of 2,000 consumers of the gas.

Mr. Neal—I hope the Association will pardon me for rising to make so many motions, but I move that this subject be postponed to the next meeting. We are gasified and nauseated by the consideration of the subject, and as I am one of the committee who are to report, and if I heard much more, as I said before, I shall be entirely in the dark. Therefore, I move that the further consideration of the subject be postponed until the report of the committee at the next meeting. Carried.

It was moved that the Association take a recess of fifteen minutes, to partake of a refection furnished by the Brooklyn Gas Company. Carried.

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Mr. G. A. Hyde, Engineer of the Cleveland Gas-Light and Coke Company, then read a paper

On Purification.

Mr. Chairman, and Gentlemen of the Association: At the last meeting of this Association, held at Cleveland, I was requested, and I assented, to prepare a paper on the subject of Purification, to be presented at this meeting. My friend who suggested my name and myself, in assenting, had in view the reporting of the results of a trial of the use of oxide of iron for purifying, as at that time our company had just commenced the use of it. Had I reflected a moment, I should not have assented to write on a subject of so much importance; as an intelligent paper on that subject, to be presented to a body of so learned and skilled gentlemen as this, should be written by a competent chemist, and I do not profess to be a chemist or the son of a chemist.

I will, however, make a statement of the composition of the purifying material we have used in our works during the present year and some of the results thereof. They will not, however, be as thorough or complete as they should be, as sufficient time has not elapsed to arrive at all of the results; and further, I have not, from a press of other duties, been able to give the time to the subject that I ought.

Previous to the present year our company has used the hydrate of lime for purifying, but the offensive odors arising from it, after being removed from the purifying boxes, induced a change to the oxide of iron, as the gases escaping from the iron while ventilating and reoxidizing, are less offensive than from lime.

The composition of the material used was one part iron borings, eight parts sawdust, and three parts of hydrate of lime; the mass saturated with liquid sulphate of iron. The mass is placed in the purifying box in bulk, on a single layer of trays. When foul, the

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mass is removed and spread out, and exposed to the atmosphere for reoxidation. The mass was found to purify more gas on each succeeding trial, until the iron was thoroughly oxidized.

The iron, sawdust, etc., in quantity sufficient to charge all of the purifiers, and a surplus for changing, costs about the same as the lime used for purifying during a period of four months, and after is used without cost except for labor, which including remass from the purifiers, ventilating, and replacing, is not far from the cost of slaking lime, charging and emptying the boxes, with the same.

The statements of expenses are probably not new to most of you, gentlemen; but having been requested to present them, I do so with pleasure, as I desire to add my mite to the interchange of opinion on the great subject of gas making.

It was moved and seconded, that the paper of Mr. Hyde be received and placed on file, with the thanks of the Association. Carried.

Mr. Clegg—If in order, I would like to request a statement from Mr. J. E. Condict, of New York City, on the subject of the manufacture of coal gas. We are full of petroleum, but I should like to hear something about the new system of making gas from coal alone, as now carried on at Yonkers.

Mr. Condict—Mr. President, and gentlemen of the Association: I regret that the engineer of the works referred to—the Yonkers Gas-Light Company—is not present here to-day, that he might read a paper which he prepared, on the process now used at those works. If I had expected to bring this subject before the Association, I would gladly have prepared a paper showing the manner in which the process is carried on. By referring to the diagram herewith presented, you can readily see how the new benches are constructed at Yonkers, and in what respect they differ from the old setting.

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I will not take up your time, gentlemen, to go into any chemical analysis of this process, but simply state a few commercial facts, which may serve as a basis for your opinion as to the value of this system.

A bench of six retorts was constructed, exactly as you see on the diagram, in September, 1873, and about the first of the following month it was fired up, and for nine consecutive months, without the intermission of a single hour, was kept in operation. The net results of using Westmoreland coal (with the exception of two tons of Murphy Run coal) in continuous running for nine consecutive months, averaged 12,000 feet of gas, of over 17 candle power, per ton of coal.

After it had been working thus two or three months, the engineer of the Yonkers company, Mr. Slade, came to our works in New York and made a test. A week later he made a second, and on the following week a third. These tests not only embraced all the matters pertaining to details of manufacture, the quality and permanent character of the gas, but also extended to every mechanism employed, within or without the works, from the scales for weighing the coal, to the consumers' meters for measuring the quantity of gas sold.

On his recommendation a bench was constructed at Yonkers. That bench, after running three or four months, and proving satisfactory, was followed by the changing of the entire works to this process. It is of interest to all of the stockholders in every gas company, and to every gas engineer, to know the simple fact that we can get 12,000 feet of 16 to 17 candle gas out of Westmoreland coal, as against 9,500 feet by the old process. You will notice, by referring to the diagram, that it has a bench of six retorts. The three connected retorts on the right, and three on the left, form two entirely independent series, the lower and middle retorts of each side being connected by a stand pipe, as shown in the drawing, and the middle and upper retorts in the rear, by an

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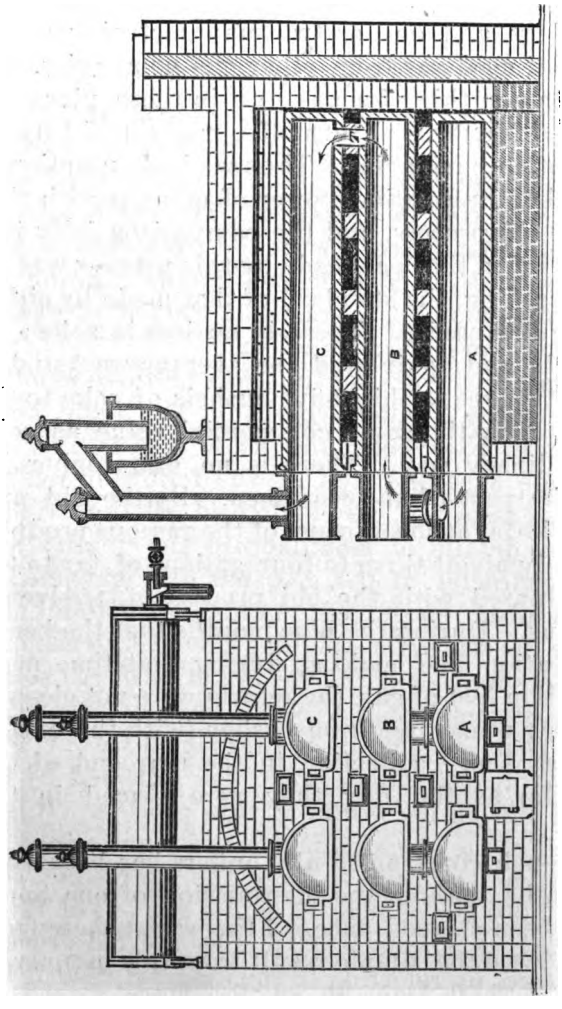
opening at the back end, through two saddle-ties placed side by side.



EXPLANATION.

Retort A communicates with B by vertical pipe between mouthpieces A and B; and B with C by tile opening T. All of the retorts are charged with coal; the upper retort, "C," being charged the heaviest. No super-heated steam, oil, naphtha, or enriching coals are used.

We charge all three of the connected retorts on one side of the bench simultaneously, and at the end of two hours, the three on the other side, and the gas is worked off in the same length of time as in the ordinary process.

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The candle power was tested by three separate photometers, and found to average over 17 candles. We had another practical test. The gas was used in several large buildings, and one or two manufacturing establishments that used gas from other gas companies, and it was a common thing for us to go in these places, at the request of friends, and turn off our gas, and turn on the gas of other companies. Thus we had an option of comparing the illuminating power of our gas with that made by the old process, and the comparison fully justifies the assertion that gas made by this process was up to, if not exceeding, the standard of that made by either of the other companies. There is no loss in coke; we tested it again and again, and the average we found to be from thirty-three to thirty-five bushels of coke to the ton, and of fully the same commercial value as coke from the ordinary way. There is no extra labor involved on the part of the workmen. By the old process, you make tar at the expense of the gaseous product. We make only about three to four gallons of tar to the ton, as compared with the old process of twelve to fifteen gallons. During the nine months that the bench was in operation, and making during that time more than six million feet of gas, the retorts were not cleaned once, and they are as free from carbon (with the exception of a very small collection in the rear end of the upper retorts) as the day they were placed in the benches.

The first bench constructed at Yonkers has been running six months, without the intermission of one hour, and has not been cleaned once. I throw out these facts that you may see the simple result from this manner of setting, and I shall leave to parties more versed in chemical affairs than I, to give a reason why such results are obtained. I will go still further and state that the Yonkers works, after they had run one bench three months, and experimented very carefully in regard to that bench, as compared with the old works, decided to

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take down other benches that were nearly new and in good order, and reconstruct them on this plan, believing that they would save the expense of reconstruction (over $1,500) in three months' time. The result has proved that to be the case. The cost of building a bench of six retorts by this process, commencing at the foundation, is not as great as by the old. You notice in this two stand pipes, and in the old you have six.

To change a bench of the old retorts to this new setting is a matter of very small moment. I feel, gentlemen, that any improvement, coming from what quarter it may, that will add to the quantity of gas, keeping quality the same as it is now, is deserving of investigation. I should be glad to answer any questions from any one.

In reply to questions Mr. Condict made the following statements;

We work by the same heat as by the old process.

We find no obstruction whatever in the rear opening; the opening is from 12 to 14 inches in size, and has never been closed.

We use the same exhauster as in the old works. The entire works, aside from the setting of retorts, is the same as the old process.

We use the long ton in making our estimates.

We have made as high as 14,000 feet, during the entire nine months, averaged 12,000 feet of 17 candle gas; without any enriching coal, and without a pound of coal (excepting Westmoreland) other than the two tons referred to of Murphy Run coal.

I will mention one fact—that the Yonkers works have used only Clover Hill coal (which you know is inferior to Westmoreland) that cost them on the docks $6.50 a ton, and their gas to-day is a little too rich. They get over 11,000 feet from this Clover Hill coal, while we obtained 12,000 feet from Westmoreland.

A simple way to overcome the stoppage is to introduce a little jet of steam in the hydraulic pipe or stand

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pipe either. They are nine feet retorts; they were 14 by 23 by 9 feet.

We have turned our attention to the difference in the gas that has passed through other meters, and examined that question thoroughly, particularly so by the engineer of the Yonkers works, and there was a loss, a little rising of 5 per cent., between the consumers' meters and the station meter.

We had no trouble with naphthaline. I have no doubt that naphthaline generated in any pipe can be easily got rid of by a little steam.

The tar is not as soft as the tar ordinarily is, but it flows off easily. At the Yonkers works it flows through nearly 200 feet, almost level. No obstruction. The ordinary clay retorts cost about $55 each.

The President—Application is made for membership by Mr. Charles H. Simpkins, of California, and Mr. W. H. Beggs, of San Francisco. They are recommended by Mr. Olney and Mr. White, and the Executive Committee endorse the application. Also, application is made by Mr. Matt Cartwright, of the Citizens Gas Company of Rochester; also approved by the Executive Committee.

It is moved and seconded that these gentlemen be declared elected members of the Association. Motion carried.

Mr. McIlhenny—Has any place been designated for the next semi-annual meeting?

The President—The place for the semi-annual meeting is left for the Association to determine.

Mr. Harbison moved that the next semi-annual meeting be held in the month of May.

In deciding upon a place in which to hold the semi-annual meeting, the following places were voted upon in order: Hartford, Conn.; Cincinnati, Ohio; Indianapolis, Ind.; Dayton, Ohio, and the city of Washington.

Mr. Nettleton—Some of the members who were at the

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meeting a year ago, will bear in mind that I thought we had better have one meeting a year, and spend our efforts in having one good meeting. At that time it was put to vote and it was a very close one. I still think the same, that if we have one meeting a year, and have special effort, and have a good one, it will make it more valuable to us than going to different parts of the country.

The President—The question before this Association is—Shall we meet in the month of May next?

Motion carried.

After balloting on the above-named places, the city of Washington was decided upon as the place in which to hold the next semi-annual meeting.

In remarks made by Mr. McIlhenny, of Washington, he said that the object of these meetings is to stimulate the members of the Association to excel in their profession. Aside from the special character of the gathering, there would be sufficient reason why this Association should enlarge and become permanent, and, if I might allude here to the facts, a year ago it came very near dying a natural death, but now the evidences are that it is on a permanent basis, and will remain so for some time at least. Questions of differences of opinion as regards changes or improvements, or whatever they may be, in the manufacture of gas, have nothing to do with the permanency of this organization, and I hope, therefore, that all the gentlemen present, and as many more as will come, will visit Washington in May, and if I am there and alive and well, I will endeavor to extend to them as cordial a greeting as I possibly can.

It is moved and carried, that Mr. McIlhenny, Mr. Cartwright, and Mr. Nettleton, be appointed as a committee of arrangement for the meeting in Washinton.

Mr. Stebbins—I want to introduce to the favorable notice of this Association, a regulator or steam governor, which is now partially in use; a steam governor that Mr. Nettleton has in use, and others have them;

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and I would like him to make a statement in reference to it, if it is in order. It is of great practical value to every gas company.

Mr. Nettleton—I suppose Mr. Stebbins must refer to Slade's Automaton Fire Governor. I use one to regulate the fire, and that regulates the exhauster. I will say this, that since I used it my fuel goes 50 per cent. further than it did before. It does its work well. You fill up the fire box with fuel and it takes care of itself. I have no interest in it except as I use it.

Mr. Stebbins—It is a very inexpensive article, and is the invention of a man at Yonkers; and some of you gentlemen will go, doubtless, and see the way of making gas that has been mentioned by Mr. Condict, and you will see that at the same time.

Mr. Nettleton—At the last meeting in Cleveland, it was voted that we print in book form the proceedings of the Association, from the beginning up to the present time. It was supposed it would cost less than $100, in suitable book form, so as to be kept in the library, and as a nucleus of the future library of the Association. When we came on to New York we found the expense of 500 copies would be $250, and 1000 copies $285, so we have not ordered it, and not only that, but the proceedings of this meeting should be printed with it; the printing to include the discussions and the papers that are read.

Mr. Harbison moved that the former proceedings and the present one be printed, and that they be limited to two copies for each member—250 copies.

It is moved as an amendment that 500 copies be printed.

The amendment was accepted, which was put and carried.

It is moved and seconded, that the thanks of this Association be presented to the Treasurer, Mr. DeMill, and that the $100 already appropriated by him is to be received by him for compensation for his services. Carried.

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The Chairman of the Committee appointed to examine into the Financial Condition of the Association, reported that the committee examined the books and the accounts of the Association, and found them correct.

It is moved that the Treasurer's report be published in the proceedings. Carried.

It is moved and seconded, that a vote of thanks be tendered to the *American Gas-Light Journal*, for the courtesy received from it in publishing the proceedings of the Association. Carried.

Captain White moved that a vote of thanks be presented to the President, for the able and dignified manner in which he has presided over this Association. Carried.

Mr. White moved to adjourn. Motion carried.

The President—I shall be most happy to see you in my works, in the city of New York, and I shall be happy to see you at my house or at my office. The works and books of the Manhattan Gas-Light Company are open to your inspection.

I now declare this meeting adjourned to the second Wednesday in May, at 10 A. M., in the city of Washington, District of Columbia.

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TREASURER'S REPORT FOR 1873–4.

DR. THE AMERICAN GAS-LIGHT ASSOCIATION *in Account with* P. E. DEMILL, *Treasurer.* CR.

1873.					
Oct.	16,	To Cash	Beloit Gas-Light Co.	$10	00
		" "	Peekskill Gas-Light Co.	10	00
		" "	East Chester Gas-Light Co.	10	00
		" "	Brooklyn Gas Light Co.	10	00
		" "	Bridgeport Gas-Light Co.	10	00
	17,	" "	Rec'd Henry Wurtz, late Sec'y, for furniture	30	00
		" "	Balance in his hands, paid me	26	00
Nov.	6,	" "	L. M. Moyes, Eng. and Builder, Sidney, Ohio	10	00
		" "	Contribution in October	21	00
Dec.	23,	" "	J. J. Tucker, of Flint, Mich	10	00
		" "	Vicksburg Gas-Light Co., Miss.	10	00
1874.					
Jan.	2,	" "	Easton Gas-Light Co., Pa.	10	00
	8,	" "	Syracuse Gas-Light Co., N. Y.	10	00
	24,	" "	Burlington Gas-Light Co., Iowa.	10	00
Feb.	6,	" "	Bloomington Gas-Light Co., Ill.	10	00
April	15,	" "	Dayton Gas-Light Co., Ohio.	10	00
May	8,	" "	Columbia Gas-Light Co., Pa.	10	00
		" "	St. Paul Gas-Light Co., Minn.	10	00
		" "	Monroe Gas-Light Co., Mich.	10	00
	9,	" "	Yonkers Gas-Light Co., N. Y.	10	00
		" "	Buffalo Gas-Light Co., N. Y.	10	00
	12,	" "	Columbus Gas-Light Co., O.	10	00
	13,	" "	Corning Gas-Light Co., N. Y.	10	00
		" "	Dunkirk Gas-Light Co., N. Y.	10	00
		" "	Worcester Gas-Light Co., Mass.	10	00
		" "	Peoples Gas-Light Co., Ohio.	10	00
		" "	Springfield Gas-Light Co., Ohio.	10	00
		" "	Hickenlooper, Cincinnati, Ohio.	10	00
		" "	Coldwater Gas-Light Co., Mich.	10	00
		" "	Citizens Gas Light Co., Cal.	10	00
		" "	Laporte Gas-Light Co., Ind.	10	00
		" "	Augusta Gas-Light Co., Ga.	10	00
		" "	Charleston Gas-Light Co., S. C.	10	00
		" "	Adrian Gas-Light Co., Mich.	10	00
	15,	" "	Dorchester Gas-Light Co., Mass.	10	00
		" "	Roxbury Gas-Light Co., Mass.	10	00

1873.					
Oct.	18,	By Am't paid Astor House use of room		$15	00
		" " paid Mr. Wurtz, ex. of package			60
	31,	" Express charges on papers to Detroit		1	20
Nov.	18,	" Am't of rent of hall, 15 and 16 Oct., Annual Meeting		100	00
		" Exchange on draft			10
Dec.	22,	" Discount on check, Mr. Moyes, Ohio			25
1874.					
March	24,	" Printing Constitution,		19	75
April	29,	" P O. cards' notice.		6	50
		" Letter envelopes		17	10
		" Treasurer's printing		2	00
May	9,	" O. S. Gulley, printing		3	50
		" Letter-filer		1	00
	14,	" W. H. Williams, per order of Asso'n		40	00
	15,	" Rent hall in Cleveland		15	00
		" Paid services of Secretary on account		100	00
Oct.	19,	" Paid printing Constitution		12	00
	21,	" Wm. Henry White, printing, &c		16	50
		" P. E. DeMill, Secretary		150	00
		Balance		246	50

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	"	"	Iowa City Gas-Light Co., Iowa.	10 00
	"	"	Millville Gas-Light Co., N. J...	10 00
Oct.	21,	"	"	Geo. D. Cabot, Mass	10 00
		"	"	Charlest'n Gas-Light Co., Mass.	10 00
		"	"	Lowell Gas-Light Co., Mass...	10 00
		"	"	Holyoke Gas-Light Co., Mass..	10 00
		"	"	E. N. Snow, Chicopee, Mass...	10 00
		"	"	Geo. Olney, N. Y.....	10 00
		"	"	Mott Haven, N. Y.....	10 00
		"	"	Marcus Smith, Wilkes Barre, Pa.	10 00
		"	"	Wm. H. Denniston, Pitts'g, Pa.	10 00
		"	"	Wm. H. McClelland, Pitts'g, Pa.	10 00
		"	"	A. B. Slater, Providence, R. I..	10 00
		"	"	T. Littlehales, Ont...	10 00
		"	"	L. C. Hanford, Conn.....	10 00
		"	"	J. H. Cowing, Buffalo, N. Y....	10 00
		"	"	H. A. Brooke, Albany, N. Y...	5 00
		"	"	Isaac Battin, Albany, N. Y....	10 00
		"	"	H. F. Coggshall, Fitchb'h, Mass.	10 00
		"	"	F. E. Harrison, New Haven, Ct.	10 00
		"	"	Jno. P. Harbison, Hartford, Ct.	10 00
		"	"	Geo. Dwight, Springfield, Ct...	10 00
		"	"	P. Munzinger, Doyleston, Pa...	10 00
		"	"	Wm. Henry White, Brooklyn..	5 00
		"	"	Paterson Gas-Light Co., N. J..	5 00
		"	"	J. N. Coldren.....	5 00
		"	"	Metropolitan Gas Light Co....	10 00
		"	"	Metropolitan Gas-Light Co., '74.	5 00
		"	"	Hamilton Gas-Light Co., Ont..	5 00
		"	"	Worcester Gas-Light Co., Mass.	5 00
		"	"	Hudson Gas-Light Co., N. J...	10 00
		"	"	Beloit Gas-Light Co.....	5 00
		"	"	H. Cartwright, Bridgeport, Ct.	5 00
		"	"	Wm. Cartwright, Oswego.....	5 00
		"	"	J. D. Patton, Trevorton, Pa....	10 00
		"	"	J. D. Patton, Trevorton, Pa , '74.	5 00
		"	"	J. S. Chambers, Trenton, N. J..	5 00
		"	"	H H. Edgerton, Ft. Wayne, Ind,	10 00
		"	"	H. H. Edgerton, Fort Wayne, Indiana, 1874.....	5 00
		"	"	Tho's Curley, Wilmington, Del.	5 00
		"	"	J. Elliott Condict.....	10 00
				$747 00

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